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ORIGINAL

Evaluation and Management of Diabetic Neuropathy from the Perspective of People with Diabetes

Evaluación y tratamiento de la neuropatía diabética desde la perspectiva de las personas con diabetes

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ABSTRACT

Diabetic foot ulcers (DFU) and infections are the most common complications of diabetic foot disease. Mortality and financial burdens for both patients and society on the whole are caused by the prevalence of complications. Peripheral neuropathy, peripheral arterial disease, and immune response dysfunction are just a few of the main contributing factors that must be understood in order to effectively treat the condition. In order to treat diabetic foot disease, you must first get a comprehensive physical examination and a detailed history of your condition. Diabetic neuropathy and peripheral vascular disease, as well as any evidence of diabetic foot ulcers or infection, should be examined during this procedure. Patients with diabetes mellitus were studied to see if there was a link between cognitive impairment and the condition of their feet and whether or not they followed their doctor's recommendations for glycemic control. Using a random sample of diabetes patients, researchers conducted a prospective study to see how many people had the condition. The Mini-Mental State Valuation, the Trail Making Judgments, and the Michigan Screening Instrument were used to assess cognitive abilities. In the one-month follow-up, glycated hemoglobin (HB1Ac >7 %) was linked to the MMSE and medication adherence, but no link was seen between cognitive function and neuropathy. According to the results of a ROC curve investigation, HB1Ac and the MNSI score both significantly (p< 0,05) mitigate towards eventual adherence to medicine for foot problems. For the purpose of determining if DFU was associated with cognitive impairment, the Chi square valuation was used in the statistical examination. As a determinant of MMSE and MoCA scores, the researchers used linear regression to come to their conclusion. Diabetic foot issues should be managed with good blood sugar control and less acute neuropathy, and this does not seem to be linked to cognitive dysfunction. More study is required in order to personalize treatments for diseases of the central and peripheral nervous systems appropriately. Cognitive dysfunction should be taken into account by doctors and podiatrists while treating diabetic foot problems.

Keywords: Cognitive Dysfunction; Diabetes; Diabetic Complication; MMSE; Moca; Neuropathy; Skin Diseases.

RESUMEN

Las úlceras del pie diabético (UPD) y las infecciones son las complicaciones más frecuentes de la enfermedad del pie diabético. La prevalencia de las complicaciones provoca mortalidad y cargas económicas tanto para los pacientes como para la sociedad en general. La neuropatía periférica, la enfermedad arterial periférica

y la disfunción de la respuesta inmunitaria son sólo algunos de los principales factores que contribuyen a la enfermedad y que deben conocerse para poder tratarla con eficacia. Para tratar la enfermedad del pie diabético, primero debe realizarse un examen físico completo y un historial detallado de la afección. Durante la misma deben examinarse la neuropatía diabética y la enfermedad vascular periférica, así como cualquier indicio de úlcera o infección del pie diabético. Se estudió a pacientes con diabetes mellitus para ver si existía una relación entre el deterioro cognitivo y el estado de sus pies y si seguían o no las recomendaciones de su médico para el control glucémico. Utilizando una muestra aleatoria de pacientes con diabetes, los investigadores realizaron un estudio prospectivo para ver cuántas personas padecían esta afección. Se utilizaron el Mini-Mental State Valuation, el Trail Making Judgments y el Michigan Screening Instrument para evaluar las capacidades cognitivas. En el seguimiento de un mes, la hemoglobina glucosilada (HB1Ac >7 %) se relacionó con el MMSE y la adherencia a la medicación, pero no se observó ninguna relación entre la función cognitiva y la neuropatía. Según los resultados de una investigación de la curva ROC, tanto la HB1Ac como la puntuación MNSI atenúan significativamente (p< 0,05) la posible adherencia a la medicación para los problemas de los pies. Para determinar si la DFU estaba asociada al deterioro cognitivo, se utilizó la valoración Chi cuadrado en el examen estadístico. Como determinante de las puntuaciones MMSE y MoCA, los investigadores utilizaron la regresión lineal para llegar a su conclusión. Los problemas del pie diabético deben tratarse con un buen control de la glucemia y menos neuropatía aguda, y esto no parece estar relacionado con la disfunción cognitiva. Se necesitan más estudios para personalizar adecuadamente los tratamientos de las enfermedades de los sistemas nerviosos central y periférico. Los médicos y podólogos deberían tener en cuenta la disfunción cognitiva al tratar los problemas del pie diabético.

Palabras clave: Disfunción cognitiva; Diabetes; Complicación Diabética; MMSE; Moca; Neuropatía; Enfermedades de la Piel.

INTRODUCTION

Diabetes mellitus (DM) has become an important public health Problem, and it is the largest cause of hospitalization in Western countries. Even among the young and fat, the incidence of type 2 diabetes (T2DM) continues to rise at an alarmingly rapid rate.[1,2,3,4,5] As a result, long-term complications from diabetes are expected to grow during the forecast period. Diabetic foot complications and disabilities can have a significant influence on one's quality of life. Neuropathy, ischemia, or both can induce foot ulcers in people with diabetes mellitus.[2] Initiating injuries can be caused by either a single incident of mechanical or thermal damage, or a long-term or constant mechanical stress.

It is not uncommon for foot ulcers, neuropathy, and peripheral vascular disease to lead to amputations and even early death. Early identification and a multidisciplinary team effort should be adopted in order to overcome these obstacles. Comorbidity management is critical to therapy success.[3] Diabetes-related problems are projected to increase in prevalence as patients with DM live longer. According to a recent study by the American Diabetes Association, around 90 % to 95 % of people with diabetes are associated with insulin resistance.[4] People with t2dm are commonly admitted to hospitals for problems of the lower extremities, such as amputation, inflammation, or gangrene. Illnesses have a negative impact on both the patient and the healthcare system (DFUs). Each year, more than a million people with type 2 diabetes have a leg amputated as a result of the disease.[5] Foot ulcers are the most common cause of DM-related amputations. The most major reason of lower-limb amputation in diabetics is foot ulcers. Many persons with diabetes are at risk of foot problems due to pathological abnormalities in their lower extremities, which are aggravated by minor trauma and infection when they are not appropriately treated.[6] There are a number of conditions that can lead to DFU, including that of the trinity of vasculopathy, neuropathic, and infection susceptibility.[7] Some specialists believe that peripheral neuralgia and peripheral vascular dysfunction are the most significant predictors for diabetic foot issues.

There must be a thorough grasp of the pathophysiology of foot ulceration, as well as awareness that a well-coordinated multidisciplinary team approach is preferable for achieving limb preservation. In order to avoid foot lesions and reduce the likelihood of amputation, every effort should be made to treat any ulcers that already exist as soon as they appear.[8] After healing, people with diabetes mellitus (DM) who have had ulcers in the lower extremities should keep an eye out for signs of recurrence.[9] To administer the MMSE, there is no need for expensive or specialist equipment or training. It has, however, been found to be valid in detecting and tracking Alzheimer's disease progression. The examination's simplicity and short duration make it an appealing tool for evaluating cognitive ability in the clinic or at the request of the patient.[10]

The MoCA screening test for MCI has been rigorously validated, reliable, and accessible. If you're looking for a one-page testing that evaluates 30 things and takes about 5 to 10 minutes, the MoCA is the one for you.[11] It

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is possible to use the test even if you are uneducated or have a low level of education. The Alzheimer's Society has also endorsed this test, which can diagnose dementia and MCI far earlier than the MMSE.

The fundamental contributions of this research work are given below.

- This study aims to identify hazard factors for diabetic foot disease among the study participants.
- Patients should be trained on how to avoid foot ulcers in both the community and the hospital.
- DFU problems can be decreased by targeted interventions aimed at patients and healthcare providers.

Related Works

The possibility of losing protective responsiveness in the foot was studied by Esther Chicharro-Luna et al.[12] and a logistic model was developed. DPN (diabetic neuropathy) and cutaneous alterations are two features of diabetic foot complications. Our research found that older individuals (65+) with diabetic foot problems had higher - level cognitive impairments than younger adults, even when HbAc1 was not present. The presence of HbAc1 found to be correlated to the development of type 2 diabetes foot problems as well as the ageing process.

Claire Corbett et al.[13] showed a study to evaluate the association among intelligence, understanding of neuropathic pain, and diabetic health variables. Diabetes can cause cognitive problems and/or dementia, and also hasten the progression of these disorders. One of the most prevalent signs of diabetes is the diabetic foot, and spurting blood ulcers and skin problems are signs of a far more serious illness. Persons with diabetic foot complications have been shown to have an increased risk of DPN, a lower MMSE and TMT score, and a decreased adherence to clinician-recommended self-care behaviors, all of which have been studied in patients who have gone through a lot amputation or have been hospitalized for diabetic foot ulcers.

Joyce K. Stechmiller et al.[14] are discussed about Chronic venous leg ulcer (CVLU). This is becoming more common and costly to treat worldwide, and this trend is expected to continue. The molecular features of recovery versus non-healing, and also the psych neurological symptoms associated with CVLUs, have been understudied for a long time. As part of this bio-behaviorally oriented review, we are attempting to shed light on the complicated mechanisms that link CLVUs to their PNS. Wound microenvironment variables that may modify a wound's molecular milieu to elude detection by the immune system have been discovered through "omics" research. Wound formation, non-healing, and PNS all involve molecular components that, while not solely responsible, have remained largely unstudied, especially over long periods of time. It also examines our current knowledge of how immune activation contributes to the onset, duration, and aggravation of wound-related PNS, which is discussed in this review.

Emmanuel Navarro Flores et al.[15] concentrated on tackling the Diabetic Foot Syndrome problem (DFS). Recent studies demonstrate that adolescents with type 2 diabetes have slower brain activity on records of sensory-evoked abilities, and white matter tumors and infarctions are frequent and correspond with the formation of micro and macro vascular disorders. In recent years, there has been an increase in the number of studies demonstrating cognitive performance in diabetic individuals. People with type 2 diabetes diabetes had lower motor behavior, cognitive performance, computing power, verbal ability, and memory recall compared to non-diabetics, but maintained attention and focus.

Table1. Features and Challenges of the Existing Foot Care Diagnosis and Prevention

Author	Methodology	Features	Challenges
Natovich et al. [16]	Case control study	• Maintain glycemic control, and prevent and heal of Diabetic Foot. • Provides better adherence.	• Cross sectional design limits about the causality of adherence patterns.
Emmanuel Navarro Flores et al. [15]	Cognitive Domains	• Has improved performance with executive function, memory and psychomotor speed.	• The impact of preventative antimicrobial treatment on concomitant neurological illnesses, more research is needed in this area
Joyce K. Stechmiller et al. [14]	CLVUs' biological and molecular interactions with their PNS.	• Better understanding and persistence of CLVU. • Molecular factors and immune activation show the severity level of wound.	• Requires proper symptom-management interventions.
Claire Corbett, MA Clin.Psych et al. [13]	MoCA and Patient Interpretation of Neuropathy (PIN)	• Regular correlation analysis for every individual provides best outcomes. • Better understanding of neuropathy.	• It requires large training data. • It is challenging to understand.
Esther Chicharro-Luna et al. [12]	Screening	• It is capable of preventing significant contributions. • Improves the overall performance.	• Limited availability and high expenses in primary care centers.

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Natovich et al.[16] reported that those with diabetic foot were much less likely to engage in physical activity than people without diabetic neuropathy. Patients who adhere to the guidelines have far better outcomes than those who do not. Adherence is a concern that should lead practitioners in detecting non-adherent patients or those who are likely not following medical advice. This study demonstrates that a thorough investigation of the factors that influence treatment adherence amongst patients with diabetic foot difficulties is essential to the implementation of a good educational intervention.

Problem Statement

Diabetes foot care needs to be designed in an effective manner because there are few disputes with existing models, even if there are numerous approaches for the diagnosis and prevention of foot care illnesses. Diabetes has previously been linked to cognitive impairment and/or dementia, according to previous studies. The most prevalent complication of diabetes is diabetic foot, and foot ulceration and some other skin problems are signs of severe diabetes. Some research has found a correlation between diabetic foot irregularities and the MoCA and PIN as well as the MMSE and TMT rating as well as the nature of the relationship with the clinician's specific recommendations for self-care behaviors in diabetic patients who have had many amputations or have been hospitalized for diabetes complications.[13,14] Poor self-care can be aggravated in many conditions by a higher incidence of cutaneous involvement, which can be used to assess patients' cognitive impairment. But, the biological and molecular aspects of CLVUs with their PNS still require the proper symptom management intervention for better understanding of the severity level of CLVU. Even so, the treatment adherence is now confirmed to play an essential influence in the prognosis of foot ulcer prevention strategies that were previously investigated with the help of case control study.[16] An educational intervention for diabetic foot problems patients requires an understanding of the elements that influence treatment adherence. Sensory-evoked potential recordings of grown person with show signs of decreasing brain activity, and white matter lesions, infarctions, and atrophy are common, and are linked to the prevalence of micro and macro vascular issues. Antimicrobial treatment can prevent foot ulcers in cognitive domains,[15] but more study is needed to achieve effective effects. When it comes to older diabetic foot patients, HbAc1 was revealed to be the sole predictor associated with cognitive loss. Even if basic screening [12] improves overall performance, there is still a scarcity of screening technology in primary care centers, as well as a high cost that must be overcome. Effective models, however, must be used to increase the precision of diabetic foot treatment. As a result, the above-mentioned flaws may aid researchers in developing an appropriate diabetic foot care scheme.

METHODS

Diabetic Neuropathy

The International Consensus Committee on Neuropathic pain defines diabetes neuropathy as the detection of peripheral nerve injury in persons with diabetes following the removal of other potential causes of diabetic neuropathy.[17] It is not uncommon for diabetic neuropathy, among the most common long-term complications of diabetes, to manifest itself as this complication. Diabetics' foot ulcers and diabetic peripheral neuropathy are inextricably linked. Diabetic foot ulcers are seven times more likely to occur in people with peripheral neuropathy.[18,19] It is thought that neuropathy is responsible for over half of all diabetic ulcers, with the other half attributed to a mixture of neuropathic and bloodstream damage.[20] Figure 1 shows an example of neuropathy.

In diabetics, this type of neuropathy is more likely to occur. In most cases, the lower limbs are implicated, but the upper limbs may also be involved. It progresses from the distal to the proximal as the level of nerve dysfunction grows. In most cases, it manifests as anomalous sensations in a glove and stocking pattern.[21] Clinical signs of distal symmetrical diabetic neuropathy might vary widely. Anxious feelings such as tingling and burning may be described by patients as the result of this condition. Peripheral neuropathy may go unnoticed in the majority of people who have no symptoms at all. Without any prior neuropathic symptoms, patients can nevertheless emerge with diabetic foot ulceration.

Motor nerve fibers can also be damaged, resulting in muscular denervation, despite the fact that sensory nerve fibers are the most common. There is only slight deterioration in toe extensor muscle strength early on in the course of the disease. Muscle weakness in the feet and hands becomes increasingly widespread as the disease advances. The usual foot kinematics and pressure distribution can be altered as a result of this muscle loss. Joint stability and foot abnormalities might result from weakening and atrophy of tiny foot muscles. There are numerous other foot abnormalities than equines or varus deformity, such as hammering toes, cocked-up toes, and flat feet. Foot ulcers form as a result of increased shear stress and friction caused by these pressure distribution differences.[22,23,24] The aberrant sweating and rough skin with cracks and fissuring caused by diabetes autonomic neuropathy may also lead to sudomotor dysfunction.[25] Dysfunction in the thermoregulatory system and poor tissue perfusion are also linked to autonomic neuropathy.

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Figure 1. Diabetic Neuropathy

Clinical Features of Diabetic Neuropathy

Symptoms and indicators of DPN can range from mild to severe. A foot ulcer may be the initial sign of diabetes mellitus for some persons who are otherwise symptom-free. However, some patients may develop a variety of symptoms, including paresthesia, numbness, and neuropathic pain, which can be slightly bothersome to intractable and cause significant discomfort.[26,27] The occurrence of these symptoms and the length of time they last vary from patient to patient, as does their frequency. Sensory symptoms can last for a short time before going away, or they can last for a long time. The toes/distal foot are the starting point symmetrically for sensory complaints and clinical examination indicators. Sensory and motor irregularities such as weakness clawed of the toes or ankle reflexive loss, and loss of muscle mass, are common in patients with neuropathy. Legs and fingers are affected first, then upper limbs are affected as well. Patients with painful-DPN have a similar physical assessment to those who are not suffering from neuropathic pain. Patients with pure small fiber neuropathy may nonetheless have normal large fiber function in some cases.[26] Some patients exhibit what is known as the "irritable nociceptor" phenotype, which includes "positive" sensory indications including allodynia and hyperalgesia, but this is a rare occurrence.[28,29]

Diagnosis of DPN

Diabetes foot screening is a common way to discover if a patient has DPN. People with type 2 diabetes must be evaluated for DPN at the time of diagnosis because the disease is commonly detected after it's been present for a certain time.[30] However, the chance of developing diabetic neuropathic pain (DNP) is low at the time of diagnosis, thus foot monitoring should begin five years following diagnosis. Patients should be evaluated each year lower limb sensorial and vascular abnormalities. Tests for small-fiber function, such as thermal sensation laboratory tests, 128-Hz tuning fork tests, and ankle reflexes, should be done to rule out alternative causes of neuropathy. 10-g monofilament tests for the evaluation of protective feeling should also be done. DPN can be diagnosed by using the Toronto Clinicians Scoring System (TCSS), which is shown in Table 2.[32] Routine biochemical testing can be used to determine the success of glycemic and cardiac risk reduction.

There should be an evaluation if the patient's symptoms are out of the ordinary or the diagnose is not clear. Nerve conduction studies have always been the gold standard for determining big fiber function, however QST and skin biopsy can also be used to identify small-fiber neuropathy. Clinical DPN is a sign that lasting nerve damage has already happened. Modern diagnostic procedures may be able to detect the disease at an earlier stage. Using these methods as endpoints in clinical trials could help determine whether pathogenetic medicines are effective since they may be more sensitive to changes in nerve function than existing medical assessments.

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Table 2. Diagnosis tests of DPN

Tests	Purpose
Autonomic Tests	To check the blood pressure and ability to sweat in patients with symptomatic of autonomic neuropathy.
Electromyography	Muscles' electrical discharges can be measured.
Monofilament testing	Touch sensitivity can be measured.
Nerve condition studies	To determine how rapidly neurons in the upper and lower limbs transmit electrical signals.
Quantitative sensory testing	In order to learn how nerves, react to vibrations and temperature changes.

Peripheral Arterial Disease

Diabetic foot disease is caused by a variety of reasons, one of which is peripheral vascular disease (PAD). Podiatric artery disease alters the normal response of the body to foot ulcers and creates prolonged non-healing ulceration when blood flow is raised. PAD is responsible for the development of infection, the degradation of tissue, and the impairment to transmit oxygen, nutrients, and treatments. Amputation of the foot is a possibility in any of these circumstances.[33] Peripheral artery disease is more common among diabetics than in the general population.[34] Diabetic patients are more prone to suffer from PAD, with increased severity, a faster course, and an even distribution of sex.[35] Diabetes was discovered in the Framingham Heart Study in about one-fifth of those with symptomatic PAD. PAD is more likely to occur in diabetics who are older, have had diabetes for a longer time, have uncontrolled hyperglycemia, or have diabetic peripheral neuropathy.

Figure 2. Sample images of PAD

Table 3. Description associated with the Diagnosis of PAD

Terms	Purpose
The ankle-brachial index	• Simple bed-side screening tool. • The ratio of the ankle's systolic pressure to its diastolic pressure. • Range of ABI is between 0,9-1,3.
The toe-brachial index	• A Doppler probe and a tiny cuff are used to assess the systolic pressure. • Useful when ABI is greater than 1,30. • PAD can be diagnosed if the index falls below 0,70.
Segmental limb pressure assessment and pulse volume recordings	• It is dependent on plethysmography cuffs that are placed across the brachial arteries and at various places on the lower limb. • A Doppler probe can be used to detect the severity and location of PAD.
Ultrasound velocity spectroscopy and imaging	• With excellent sensitivity and specificity, duplex ultrasound can detect arterial patency and the extent of blockage.
Transcutaneous oximetry and laser – doppler Flowmetry	• MRA is used to measure the flow of blood to the skin's surface. • Vascular testing such as this is uncommon in general practice.
Computed to mographic angiography	• Unlike MRA, which cannot identify calcification, CTA is more sensitive. • Helpful in the design of revascularization plans.

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Contrast angiography	• Due to the hazards connected with invasive procedures, this diagnostic technique is rarely used. • Patients may benefit from enhanced digital subtraction angiogram for improved image resolution.

Instead of the aortoiliac arteries, where hypertension and smoking are linked to aortoiliac artery disease, diabetes is largely tied to the below-knee variety of the disease, which includes tibial, popliteal, and femoral artery dysfunctions.[36] Painful cramping and aching are common symptoms of PAD, but they can also be found elsewhere on the limbs like the thigh and buttocks if the condition is not properly diagnosed and treated early enough. The pain of intermittent claudication is so excruciating that it requires the victim to stopover walking and is eased by relaxation.[37] Pain might be felt even while the patient is at rest, a condition called the “limb ischemia", and tissue loss may be shown in the affected area (figure 2). Detailed information on the assessment of PAD can be found in table 3.

Statistical Analysis

Predictors of expertise and socio-demographic data were examined using a Chi-square test, while patients' socio-demographic data was concise using the incidence, mean, and standard deviation. Estimates of knowledge and practice-related variables were based on multiple regressions. In this study, there was a link between giving erroneous answers and saying, "I don't know". Knowledge and practice had to be brought together to better understand the relationship between different components. P-values of less than 0,01 were comprised in the multivariate models. The level of consequence was clear as a P-value < 0,05.

RESULTS

Ankle-brachial index (ABI) measurements were made manually by measuring ankle-brachial angulations in both lower limbs, as well as the posterior tibial pulses. PAD was defined as a loss of peripheral pulses when an ABI is ≤ 0,9. In order to classify the diabetic patients with foot problems, the International Advisory Committee on Diabetic Foot Risk Classification Scheme (RCS) was applied. Persons with foot at evaluation criteria 0, 1, 2, and 3 were measured for HbA1c in an equivalent number of people in the subsample group, as determined through the study and linked to age and gender. All kids were taught proper foot care procedures as part of their health education. Based on how skewed the data were when they were collected, a variety of statistical measures were applied to summarize the continuous data. The Chi-square test was used to find the connection, and a p-value of < 0,05 was found to be significant. The risk factors were discovered through the use of multiple logistic regression modeling software packages. Age, low socioeconomic level, inactivity, and a longer duration of diabetes were all found to be significant predictors of DFS in a multivariate logistic regression analysis of the data.

Using multivariate logistic regression, factors associated with diabetic foot syndrome are shown in Table 4. DFN was strongly associated with increasing age, low socioeconomic position, sedentary physical activity, and longer duration of diabetes.

Table 4. Regression factors Associated with DFS

Variable	Diabetic Foot Neuropathy		Intercept	SE	Wald	Adapted OR 95 % CI
	Absent (n=299)	Present (n=32)				
Age						
< 50 years	64	18			30,56	1
51-60 years	96	62	0,57	0,34	2,79	1,77
61-70 years	105	130	1,04	0,32	9,50	2,75
> 70 years	34	111	1,84	0,37	24,67	6,32
Socio-economic status						
Low	69	105			8,40	1
Middle	225	211	-0,60	0,21	8,11	0,54
High	5	5	-0,81	0,70	1,32	0,44
Physical Activity						
Sedentary	116	200			11,46	1
Light	175	115	-0,65	0,19	11,37	0,51
Moderate	8	6	-0,14	0,68	0,47	0,86

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Duration of DM						
0-5 years	168	95			17,74	1
6-10 years	72	100	0,74	0,22	10,51	2,10
> 10 years	59	126	0,87	0,23	14,59	2,40

Table 5 depicts diabetic individuals' knowledge and practices about foot care. 23,5 % of the participants had fungal infections, 11,5 % had shoe bites, and 26,5 % of the researchers were unsure of other risk factors. In the study, less than a quarter of patients were aware that color and temperature differences are important. Only one-third of diabetic patients were aware of the dangers of foot ulcers and decreased blood supply to the feet, which can lead to amputations. Similarly, just half of the diabetic patients were aware of the use of specific diabetic footwear. There was a strong correlation between broken foot and trauma in two-thirds of the people surveyed. Diabetic patients' foot-care habits are depicted in the second part of Table 1. According to this survey, 97,0 percent of the participants were cleaning their feet each day and wearing shoes outside 98,5 %. Wearing shoes indoors 25,5 % and applying moisturizer 19,0 % were also low on the list. Drying the feet somewhere between their toes is a major discovery because the high moisture content can lead to fungal illnesses.

Table 5. Knowledge and Practices about Diabetic Study Sample

Study Phase	Descriptions	Diabetic Subjects (198)
Knowledge	Risk of developing foot complications among diabetics	107
	Leg blood flow is diminished as a result of uncontrolled diabetes	63
	Uncontrolled hyperglycemia may result in foot numbness	78
	Uncontrolled diabetes can lead to foot ulcers	70
	Smoking increases the risk of foot ulcers	41
	Diabetics should wear footwear indoors	88
	Special footwear is available for diabetics	103
	Inspect for cracked feet	135
	Inspect for calluses	107
	Inspect for fungal infections	47
	Inspect for shoe bites	53
	Inspect for change in colour	24
	Inspect for change in temperature	19
	Inspect for ingrown toenail	43
	Inspect for foreign objects	73
	Cutting nails straight through is appropriate	97
	Inspect for injuries	132
Practices	Wash feet every day	194
	Reach bottom of feet	184
	Dry well between toes	89
	Moisturizing cream	38
	Wear footwear indoors	51
	Wear footwear outdoors	197
	Foreign object inspection	124
	Heating pad application.	59

Diabetic neuropathy (DN) affected 51,8 % of the general population. Table 6 shows that of the study's participants, 48,2 % were classified as standard (Stage 0), whereas the other 51,8 % had foot at danger according to the IGWDF Risk Classification. Approximately 51,8 % of participants had a foot at risk, with 31,3 % having foot at risk stage 1; 11,9 % having foot at risk stage 2, with 10,8 % having PAD and 10,4 % having deformity. Of these patients, 11,9 % had foot deformity. Only nine of them (or 8,5 %) fell into stage 3, which included people who suffered amputations. Most people with neuropathic symptoms, according to the MNSI, report feeling numbness in their feet, monitored by scorching pain (38,7 %) and having their feet become overly delicate to trace (33,9 %), with 26,5 % reporting that their signs worsened at night. 9,8 % of those who took part in the study had a past of foot ulcer, and 1,5 % had a toe amputated as a result. 74,5 percent of the study individuals had anomalies in foot appearance, including dry skin (41,9 %), deformities (10,5 %), amputations (1,5 %), calluses (14,5 %), infections (15,8 %), and ingrown nails, as determined by examination of the feet (7,6 %). One and a half percent of the trial participants had foot ulcers. Examined with a 128 Hz tuning fork, 45,5 % of the test individuals had diminished or absent vibration sensitivity; 34,7 % had lost their protective sense when tested with a SW

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monofilament; and 15 percent exhibited anomalous ankle impulses when examined. According to the results of the MNSI test, 51,8 % of the participants in the study had diabetic peripheral neuropathy.

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Table 6. Prevalence of DN based on IWGDF Risk Grouping System

Stages of Risk	Individualities	N	Percentage
Stage 0	There is no peripheral neuropathy	299	48,2
Stage 1	Peripheral neuropathy	194	31,4
Stage 2	Neuropathy in the limbs caused by peripheral artery disease PAD	74	11,9
Stage 3	A history of foot ulcers and peripheral neuropathy	53	85

DISCUSSION

This is possible that tissue collapse due to neuropathy, ischemia, and inflammation will be required in the case of diabetes-related foot condition. An examination of the feet should be followed by diagnostic tests for neuropathy and vascular disease. According to the study, diabetic foot concerns are poorly defined by T2DM patient's mellitus. Patients with diabetes tended to have lower educational attainment in the current study. According to research,[38,39,40,41,42,43,44,45] educational attainment has an effect on one's degree of knowledge. It's essential to understand this characteristic in order to build diabetes prevention measures. This study found a considerable discrepancy between the average practice score and the average knowledge rating, which is in line with some articles.[46,47,48,49] Patients with chronic in Western Nepal were found to have a low KAP (knowledge, attitude, and practices score in a study, and the researchers speculated that this could be due to a lack of knowledge, information, and literacy.[50]

Some studies found that people with diabetes had a high degree of awareness of the disease.[51,52,53,54] The varying levels of diabetes care knowledge among patients in various researches could be attributed to varying levels of diabetes care training provided by health care workers in various locations[55,56,57] as well as the literacy level of the examined subjects. Patients with diabetes were shown to have poor foot care practices, according to several researches. Patients[58,59], have poor practices when it comes to routine foot inspection. Patients newly diagnosed with diabetes were found to practice good foot care practices by Hamidah et al., from Malaysia.[47] A study found[60] that only 10,2 % of diabetics in Nigeria had appropriate foot care routines. Because of the differences in the study populations and measurements, it was impossible to compare the findings of this investigation with those of earlier ones.

People's practice scores rise in tandem with their knowledge scores. In other studies, it has been found that patients who've been taught how to properly care for their feet inspect their feet frequently.[61,62,63,64,65] Foot care habits of patients who are supposed to be taking care of their foot by their doctors and who are evaluated by their doctors are better.[66,67] Findings from this study show that applying talcum powder in between the toes and not using moisturizer between toes, as well as the correct way to trim toenails are the most common misconceptions, while the most common practices are applying talcum powder, keeping the foot skin soft, and preventing dryness. Moisturizing the soles of the feet is a less common habit in northern Iran because of the region's rainy weather. While it does take practice, it is possible. As a preventative measure, diabetics should avoid applying lotion to their feet and instead use talcum powder in order to keep the area beneath their toes dries.[68,69,70,71]

Knowledge was influenced by a heritage of hospitals, amputations, and consequences, as well as gender, disease duration, region of residence, and educational status. Gender, sickness duration, locality, employment, and level of education all had a significant impact on practice. Females, diabetic's patients who had been

identified for more than ten years, and those who had underwent amputation due to DFU showed higher levels of knowledge. In addition, individuals with a diabetes background of more than 10 years performed better than those who had not been diagnosed. Males were shown to be more reluctant than females to seek help for their health issues, according to the findings of this study. Males, on the other hand, had greater self-care deficits than females.[72]

This means that those who are better educated are more likely to gain a thorough understanding of their health issues, including how to properly take care of their feet. While there was no correlation found in the current study between knowledge and understanding or practice, it is possible that this is because both literate and illiterate groups lacked enough information about diabetes in local communities with poor and inadequate information resources. More research is needed to find out why patients aren't taking good care of their feet in the real world, even though they know what they're doing and have access to proper care.[73,74,75,76]

To prevent foot ulcers, individuals with diabetes should be educated on best clinical practices in the community as well as in the hospital setting. Patients' perception of disease, food and lifestyle modifications and their ability to regulate their glycemic levels can be improved by a diabetes educator's counsel during every visit. This study's findings have encouraged an optimistic outlook. As a result of the recent study's predictive qualities, additional attention should be paid to patients who experience like an inadequate knowledge, urban domicile, and single status. The vast majority of diabetics lacked basic knowledge and abilities in foot cleanliness. Patients' demographic factors and their knowledge and practice of foot care were found to have a strong correlation. Knowledge, domicile, marital status, and previous hospitalization due to DFU were all used to predict practice among diabetics.[77,78,79,80]

DFS is a complex disease, and DPN is a key component. Diabetic neuropathy can be analyzed early on using a variety of approaches, including neuropsychological tests and electrophysiology. The MNSI has been proven to be a simple and reliable test for diagnosing diabetic peripheral neuropathy in Indian settings.[81] In this investigation, both tiny and large nerve fibers are tested for pain and hyperesthesia. At a cutoff value of 2,5, MNSI showed 50 % sensibility and 91 % specificity.[82] The study population had 51,8 % of those with diabetic peripheral neuropathy utilizing MNSI. An study[83] conducted similar experiments in Tamil Nadu, India, and found similar findings.

CONCLUSIONS

Diabetes mellitus and its related disorders can only be adequately controlled with sufficient information and appropriate behaviors. Neuropathy was the most common ailment reported by patients. They have a very low level of expertise of the subject matter. Many people are unaware of the serious implications of uncontrolled diabetes, like foot ulcers and reduced sensation in the feet. Wearing shoes indoors and applying moisturizer to the feet were the only things that didn't work out for the majority of people. It was determined that diabetic foot risk factors have been studied. People with diabetes, a history of foot ulcers, and a lack of knowledge about dry skin were all related with a higher risk of developing foot ulcers. For those who have Type 2 diabetes mellitus, adequate foot care is essential. In tertiary care facilities, special foot counters may be built to measure risk and offer advice on foot care. In order to properly control diabetes, patients need the support of their families and the wider community to amend their lifestyles and behaviors and mark long-term variations. To effectively control diabetes mellitus in the community, knowledge on the disease and its threats should be disseminated via the media. The medical provider should conduct a foot examination and educate the patient on foot care at every diabetic session in both primary and secondary care settings. This should be done on a frequent basis. As a result of varying methods of care across India, long-term reductions in diabetic foot injuries are needed to be studied further.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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