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Recent Innovative Strategies in the Prevention and Management of Diabetic Foot Ulcer World Wide: An Exclusive Review

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Abstract:
Diabetes complications have significant medical, social, and financial impacts on patients, their families, and society. Foot infections, particularly neurological ones, can be prevented through examination, ongoing monitoring, and education. Wound culture is crucial for identifying the causative agent, as antibiotic therapy cannot heal wounds. A good wound-healing environment must be combined with optimizing the patient's local and systemic diseases. Recent developments in wound care products, including nonsurgical equipment, advanced dressings, and hyperbaric organisms, have improved the environment for wound healing. New products are being used to replace or supplement various matrices in wound healing. This review provides a comprehensive overview of diabetic foot ulcers (DFU), including prevention strategies, financial and health consequences, adverse outcomes, and extension. It also discusses the role of neural tissue in vascular disease and diabetes and includes guidelines for prevention, risk assessment, and management. DFU is graded from I to V and divided into neuropathic and neurochemical types. The pathophysiology, aetiology, and epidemiology of DFU are reviewed, as are the roles of neural tissue in vascular disease and diabetes. Alginates, foam dressing hydrogels, iodine preparations, nadir, silver-impregnated dressings, drug preparations, therapy, and dressing variations. This review also includes guidelines for the prevention, risk assessment, and management of DFU (e.g., glycaemic control, drug therapy, and self-diagnostic foot care). A database search and PRISMA data extraction formed the basis of the analysis.

Introduction

One of the most common diseases is diabetes. In 2010, it was estimated that 285 million adults worldwide were living with the disease, and by 2030, this number is expected to rise to 439 million (International Diabetes Federation, 2021). High blood sugar levels and abnormalities in protein, lipid, and carbohydrate metabolism (caused by changes in insulin action, secretion, or both) are symptoms of the metabolic disease diabetes. There are three types of diabetes: type 1, type 2, and gestational diabetes (Patole et al., 2023).

The effect of low blood pressure is very beneficial for people with diabetes. This article reviews the various causes of diabetic foot pain and discusses evaluation and treatment options that will help healthcare professionals develop appropriate foot care strategies for people with diabetes. Diabetics suffer from DFU, which affects approximately 25% of diabetic patients (Lim et al., 2017). DFU occurs in 80,000 amputations each year in the United States and accounts for 14% to 24% of lower cervical amputations during this disease. Management of DFU includes evaluation and treatment. It also includes the site and condition of the wound. Diabetes, history of previous DFU, previous amputation, DFU risk

factor peripheral vascular symptoms, and medication use were part of the comprehensive evaluation of people with diabetes. In addition, DFU patients receive diabetes treatment and medical care. Appropriate management of the wound site and metabolic processes is important when treating a DFU. Appropriate blood sugar control, foot care, diet, and exercise are key components of a strategy to promote wound healing and prevent recurrence of DFU (Yazdanpanah, 2015).

The pharmacological treatment of DFU remains challenging. A better understanding of the pathophysiology and molecular biology of diabetes will lead to improved diabetes and improved treatment. It is now generally accepted that the goal of DFU repair should be to solve the problem. To correct DFU, it is necessary to comply with the goal of DFU repair. Wound healing to heal the skin is an intensive process that requires a variety of macro and micronutrients (Jalilian et al., 2020). Macronutrients (carbohydrates, fats, proteins, and fluids) and micronutrients (vitamins and minerals) work together to maintain the proper process of wound healing. Increased nutritional needs during treatment are indicated by the caloric content for protein synthesis, which is important for the formation of granulation tissue (Seth et al., 2024).

Nutrition has an impact on the appearance of wound healing; larger wounds, especially hot flashes, will lead to malnutrition, which increases the risk of fasting and may affect healing time. Nutrition is important for healing (Seth et al., 2024). On the other hand, a small wound will not benefit the body. Uncontrolled hyperglycemia has been shown to affect fibroblast and endothelial cell function, especially in diabetic patients. The history of vitamins, including the association of vitamin C with scurvy, highlights the role of vitamins as co-substrates for hydroxylase, which is essential for collagen synthesis. Similarly, the roles of zinc and vitamin A in wound strength, collagen synthesis, angiogenesis, epithelial development, and epithelialization have been established. However, there has been controversy over the effectiveness of supplements in treating malnutrition (Yuan et al., 2023).

In addition to food, lifestyle choices such as smoking and increased alcohol consumption are also recognized to have adverse effects on health. Uncontrolled hyperglycemia has been shown to affect fibroblast and endothelial cell function, particularly in diabetic patients. The history of vitamins, including the association of vitamin C with scurvy, highlights the role of vitamins as cosubstrates for hydroxylase, which is essential for collagen synthesis. Similarly, the roles of zinc and vitamin A in wound strength, collagen synthesis, angiogenesis, epithelial development, and epithelialization have been established. However, there has been controversy over the effectiveness of supplements in treating malnutrition. It is recognized that lifestyle choices, such as smoking and drinking more alcohol, as well as eating, have negative effects on health. The form is simple and effective. Up to 25% of people with diabetes are at risk of developing diabetic foot ulcers (DFU), the most common and dangerous side effects (Boulton et al., 2018).

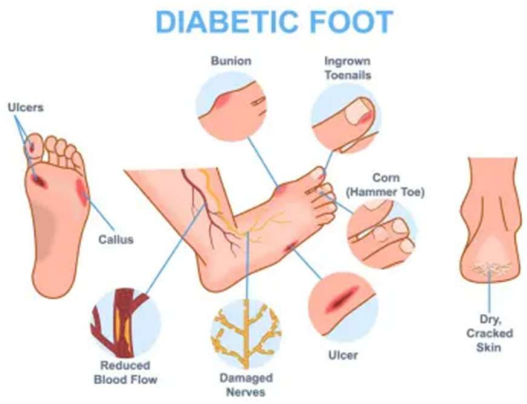


Figure 1 Diabetic Foot Ulcer

Topical application has the advantage of self-administration, which makes it superior to oral application and hypodermic doses. Film solutions are a revolutionary method that overcomes all the shortcomings of cosmetics or leaflets. When these systems are used on the skin, a layer of drugs and excipients is left behind after solvent evaporation because the carrier contains drugs and suitable excipients (Kathe & Kathpalia, 2017). After the formulation is applied to the skin, the solvent evaporates, causing the drug concentration on the skin surface to reach saturation and possibly supersaturation. This level of supersaturation can improve water flow across the skin, reducing irritation and discomfort (Frederiksen et al., 2016).

After an ulcer, the pain is more likely to worsen and eventually lead to diabetes. A group of treatments can prevent at least 40% of abortions in people with diabetes. To help primary care physicians choose the best treatment for their patients, this review aims to provide an overview of the causes of low blood pressure in people with diabetes, the classification system, and treatment. The glucose and lipid profiles of microparticle formulation were akin to normal rats. Moreover, CT microparticles did not produce obesity even after 60 days which is a common side effect of antidiabetic drugs. These results indicate that the CT microparticles can be applied as potential and safe carriers for the treatment of diabetes (Meena et al., 2017).

Diabetic foot ulcers (DFU) represent a serious problem that can cause severe damage to people with diabetes. Below you can find more information about DFU and its effects (Zubair, 2015):

Prevalence: DFU is common in people with diabetes and affects up to 25% of people with diabetes, including infection, cellulitis, and osteomyelitis (bone disease). These problems are difficult to treat and will eventually lead to reduced mobility. Studies show that approximately 14% to 24% of people with DFU will eventually require amputation if the condition is not well controlled (Lim et al., 2017). They also impose a heavy financial burden on treatment. The cost of treatment for diabetic feet, including hospitalization, wound care, and surgery, is quite high. Regular foot examinations, patient education on foot care, and diabetes management are key to prevention. Podiatric care and team coordination can play an important role in the management and prevention of DFU (Boulton et al., 2018). The extent of the problem and its implications for treatment avoid and manage DFU. People with diabetes should have foot examinations and education to reduce the risk of DFU and its complications. Additionally, DFU and other diabetes-related complications can be prevented and managed with proper diabetes management (Meena et al., 2017).

Diabetic Foot Ulcer (DFU) is indeed a severe complication of Diabetes Mellitus (DM) and can have devastating consequences for individuals with diabetes. Here's some additional information on DFUs and their impact (Alavi et al., 2014):

Prevalence: DFUs are relatively common among diabetic patients, affecting approximately 25% of individuals with diabetes.

Complications: DFUs can lead to various complications, including infections, cellulitis, and osteomyelitis (bone infection). These complications can be challenging to treat and may ultimately result in lower extremity amputation.

Amputation Rates: The risk of lower extremity amputation in patients with DFUs is a significant concern. Studies have shown that approximately 14% to 24% of individuals with DFUs will eventually undergo amputation if the condition is not effectively managed (Lim et al., 2017).

Economic and Healthcare Burden: The impact of DFUs extends beyond the individual's health. They also pose a substantial economic burden on the healthcare system. The cost of treating DFUs, including hospitalization, wound care, and amputation procedures, is significant.

Preventive Measures: Early detection and proper management of DFUs are crucial in preventing amputations. Regular foot exams, foot care education for patients, and glycemic control are essential preventive measures. Podiatric care and multidisciplinary teams can also play a crucial role in managing and preventing DFUs (Boulton et al., 2018).

With the right treatment, patient education, and a multidisciplinary approach combining medical specialists like podiatrists, endocrinologists, and wound care specialists, DFUs can be avoided and controlled. To lower the risk of DFUs and its complications, diabetic individuals should have routine foot exams and education. Furthermore, DFUs and other diabetes-related problems can be avoided and managed with proper glycaemic management (Brown, 2024).

2. TYPES OF DIABETIC FOOT ULCER

Diabetic ulcers are divided into 2 groups:

2.1 Neuropathic DFU

In a neuropathic DFU, feet are warm, but perfusion is still good with pulsation still palpable, perspiration is reduced, and skin is dry and cracked (Clayton & Elasy, 2009).

2.2 Neuro Ischemic Ulcers

Feet are colder, no palpable pulsation, thin skin, smooth and without hair, subcutaneous tissue atrophy, intermittent claudication, and rest pain may not be present due to neuropathy (Clayton & Elasy, 2009).

The results of foot measurements should help develop appropriate management strategies. When a wound is found, the description should include the size, depth, appearance, and location of the wound. Various classifications are used to describe diseases to help create a consistent descriptive framework. Various physical benefits form the basis of this classification model. The Wagner ulcer classification system is one of the most commonly used classification systems based on the degree of tissue necrosis and the depth of the wound (Alavi et al., 2014). This technique has been deemed inadequate by many authors, as it only determines the depth and appearance of the wound and ignores the presence of infection or ischemia. Another classification that includes depth, disease, and ischemia is the University of Texas method. As the degree and level increase, the rate of wound healing without vascular repair or amputation decreases (Zubair, 2015).

2.3 Classification and Degree of Diabetic Foot Ulcers

There are currently several classifications of diabetic foot injuries, including PEDIS, the University of Texas Wound Classification System (UT), and the Wagner classification. Although the Wagner classification is frequently used, it does not represent ischemic events or clinical effort; rather, it describes the severity and extent of the wound. Diabetic foot is diagnosed if two or more of the following symptoms are present: pus discharge, local pain, palpable local warmth, swelling, induration, and peri-wound erythema (Yazdanpanah, 2015). These three types of disease are minor (major, major, and intrinsic only), moderate (profound and more), and severe (associated with metabolic abnormalities or systemic manifestations). The presence of compartment syndrome, a biological or metabolically unbalanced disease that threatens the patient's legs and brain health, as well as other serious conditions such as necrotizing fasciitis, gangrenous gas, and increased cellulitis swelling. Classification of Wagner grade lesions in the Ulcer Classification System (Zubair, 2015):

1. Superficial diabetic ulcer
2. Expanded ulcer without osteomyelitis or abscess affecting ligaments, tendons, joint capsule, or fascia
3. Deep ulcer with osteomyelitis or abscess
4. Semi gangrenous gangrene of the foot

University of Texas Wound Classification System Stage Definition

- **Stage A:** No infection or ischemia
- **Stage B:** Infection present
- **Grade 0:** No ulcers in high-risk leg patients
- **Grade I:** Premature superficial ulcer
- **Grade II:** Ulcer deeper, regarding tendons, ligaments, muscles, and joints, not exposed to the bone, without cellulitis or abscess
- **Grade III:** Deeper ulcers are already about frequent bone complications of osteomyelitis, abscesses, or cellulitis
- **Grade IV:** Gangrene distal toes or toes
- **Grade V:** Gangrene whole legs

The PEDIS classification system is divided into 5 categories: Perfusion, Extent/size, Depth/tissue loss, Infection, and Sensation. The classification of PEDIS is highly relevant to the pathogenesis and development of DFU (Game et al., 2012).

3. CLASSIFICATION OF FOOT LESIONS IN DIABETES MELLITUS

There are currently many classifications used to measure and determine the severity of diabetic foot, including the Wagner system, the University of Texas System and hybrid system, the classification of major ischemia, and the PEDIS system. This procedure is designed to cover various aspects of ulceration, such as size, depth, presence of neuropathy, infection, and ischemia. Peripheral vascular disease, infections, and deep wounds are often associated with poor clinical outcomes, and the effects of these diseases appear to increase the risk of diabetic foot arising in the lower leg (Clayton & Elasy, 2009).

3.1 Wagner Diabetic Foot System of Classification

Gangrene of the forefoot, suppurative osteitis, superficial ulcer, deep ulcer, and total gangrene of the foot are the classifications of this system. Infection is mentioned only in stage 3. High-risk feet without ulcers are classified as grade, while gangrene of the entire foot is classified as grade 5 (Alavi et al., 2014).

Depth-Ischemic Classification: This classification is a modification of the Wagner-Meggitt system. The purpose of this classification system is to make the classification more accurate and rational, easier to distinguish between wound and vascularity of the foot, to elucidate the difference between grades 2 and 3, and to improve the correlation of treatment to the grade (Clayton & Elasy, 2009).

Classification System of the University of Texas: The University of Texas San Antonio approach, which takes ischemia and lesion depth into account, is another well-liked approach. It is a Wagner System modification. Each Wagner System grade is further subdivided into stages in this system based on whether infection, ischemia or a combination of the two is present. According to Table 1 with the grade system, this system predicts the outcome a little better than the Wagner System (Zubair, 2015).

Table: 1 Wagner-Meggitt Classification System.

Grade	Lesion
0	No open lesion
1	Superficial ulcer
2	Deep ulcer to tendon or joint capsule
3	Deep ulcer with abscess, osteomyelitis, or joint sepsis
4	Local gangrene – for foot or heel
5	Gangrene of entire foot.

1. **4. LOCATION OF FOOT ULCER IN DIABETES**

2. The causes, treatment, and location of diseases vary according to the population of each region. In diabetic patients, ulcers are most commonly affected by the dorsal or plantar region of the foot, followed by the plantar metatarsal head and the heel. The severity of the wound is more important than the location of the result (Jalilian et al., 2020). Many people report that many factors contribute to the occurrence of DFU, regardless of the same type of care or treatment. The location of the wound was found to be important in terms of healing, poor quality, and disease leading to amputation (Game et al., 2012). The larger the wound, the longer it will take to heal. In a multivariate analysis model, Margolis and colleagues combined all five studies and found that neuropathic pain took longer to heal and that HbA1c levels did not affect treatment. After adjusting for age and sex, older and higher (±3) wounds or wounds on the foot took longer to heal. This is based on medical records of 72,525 diabetic foot ulcers in 81,106 people in 38 U.S. states. Patients in all of these studies received similar treatments, including wound debridement, conservative treatment, and debridement (Lim et al., 2017). Figure 2 describes the pathway that causes diabetic foot. This is an explanation of Diabetes: The starting point, leading to several complications (Deshpande et al., 2008).

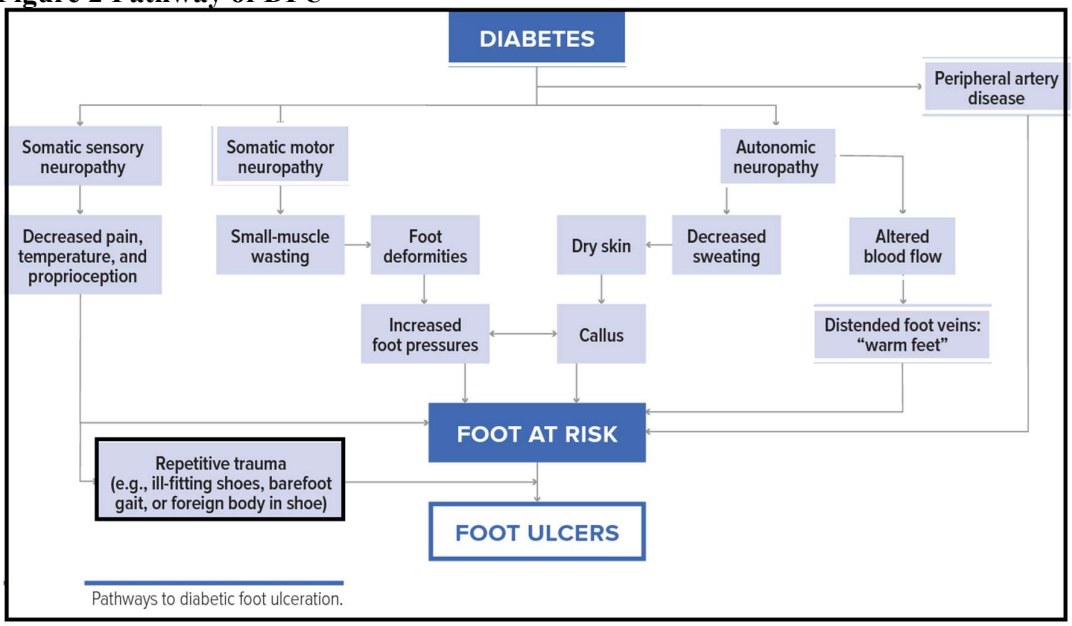
3. **Complications:**

4. **Somatic Sensory Neuropathy:** Decreased pain, temperature, and proprioception

5. **Somatic Motor Neuropathy:** Small-muscle wasting and foot deformities

6. **Autonomic Neuropathy:** Dry skin, decreased sweating, and altered blood flow
7. **Peripheral Artery Disease:** Reduced blood flow to the feet
8. **Foot at Risk:** These complications make the foot more susceptible to injuries and ulcers. Foot ulcers result from repetitive trauma, such as ill-fitting shoes or walking barefoot, leading to serious complications if not managed properly (Deshpande et al., 2008).

Figure 2 Pathway of DFU



5. PATHOPHYSIOLOGY

The main problems in the development and occurrence of diabetic foot disease—peripheral neuropathy, peripheral vascular disease, and poor response to infection—are more common in people with diabetes. Diabetes also causes difficulty in healing wounds and increases the risk of infection (Clayton & Elasy, 2009). Neuropathy in people with diabetes affects the motor, auditory, and autonomic nervous systems. The inconsistency between leg flexion and extension due to the innervation of the leg muscles is deformed and changes in pressure points. It gradually causes the skin to become sore, causing ulcers. Autonomic neuropathy reduces sweat and oil glands, making the feet wet and more prone to injury. Because sensory neuropathy reduces pain, most patients do not notice the lesion until it is more severe (Siddiqui et al., 2023). Peripheral arterial hyperglycemia causes constriction due to endothelial dysfunction and decreases endothelial synthesis of neuromuscular and vasodilator agents. In patients with diabetes, hyperglycemia increases thromboxane A2, a vasoconstrictor that causes platelet aggregation and increases the risk of a hypercoagulable state of plasma. Peripheral arterial disease is also affected by hypertension and dyslipidemia (Eming et al., 2014). The above explanation can lead to arterial occlusive disease, increasing the risk of ulcers and causing lower extremity ischemia. The resulting complications include infection, gangrene, and ultimately amputation of the lower leg (also known as below-knee amputation). Figure 3 illustrates the pathophysiology of Diabetic Neuropathy and its complications leading to Atherosclerosis and Gangrene (Clayton & Elasy, 2009).

Peripheral Neuropathy:

- **Motor Neuropathy:** Damage to leg muscle innervation leads to muscle imbalance, causing deformities and changes in pressure points, which can result in skin damage and ulceration (Siddiqui et al., 2023).
- **Sensory Neuropathy:** Reduced pain perception threshold makes individuals less aware of wounds or injuries until they worsen**.**
- **Autonomic Neuropathy:** Reduced activity of oil glands and sweat glands can lead to dry skin, making the foot more susceptible to injury**.**

Peripheral Vascular Disease: Hyperglycemia-induced endothelial dysfunction and smooth muscle changes in blood vessels can decrease vasodilation, leading to vasoconstriction. Hyperglycemia can also increase thromboxane A2 levels, which promotes vasoconstriction and platelet aggregation and increases the risk of hypercoagulability. Conditions like hypertension and dyslipidemia further contribute to peripheral arterial disease, which can lead to arterial occlusion (Eming et al., 2014).

Wound Healing Disorder: Individuals with diabetes often have impaired wound-healing processes, which can lead to prolonged healing times and an increased risk of infection (Yuan et al., 2023).

Overall, the interplay of these factors can lead to the development of DFUs. If left untreated, infected ulcers can progress to gangrene, requiring aggressive medical management and potentially leading to lower limb amputation (below-knee amputation) to prevent the spread of infection and further complications. Therefore, individuals with diabetes must manage their blood sugar levels, maintain good foot care practices, and seek medical attention promptly if they suspect any foot issues to prevent or mitigate the development of DFUs (Mariam et al., 2017)

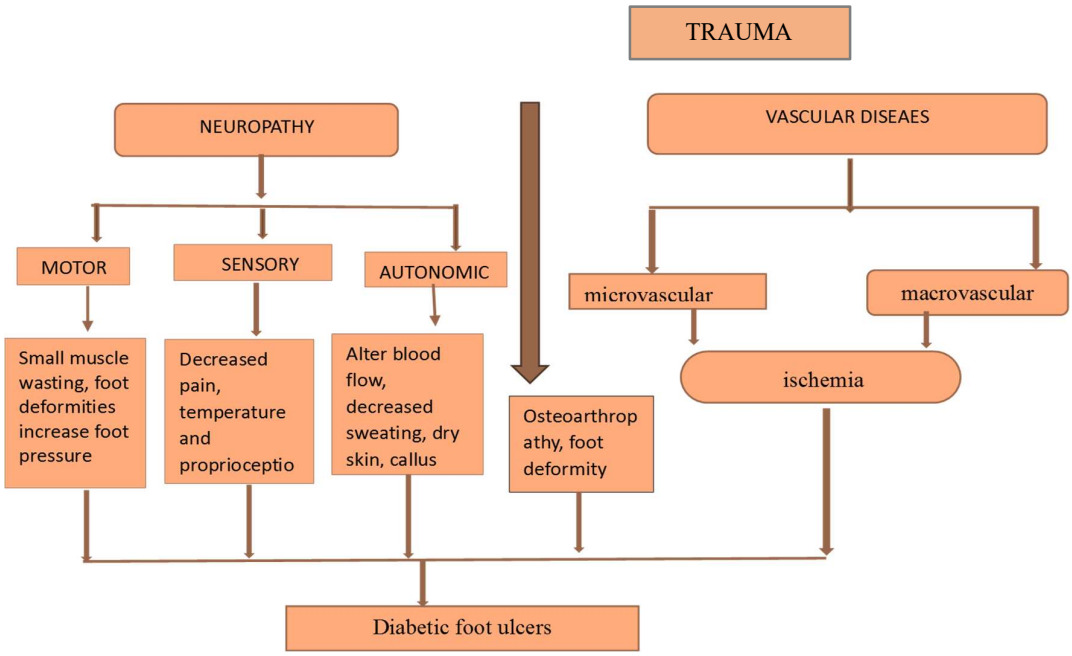


Figure 4. Flow chart representation of pathophysiology

Pathogenesis of Ulceration: Diabetic foot ulcers result from the simultaneous action of multiple contributing causes. The major underlying causes are noted to be peripheral neuropathy and ischemia from peripheral vascular disease (Alavi et al., 2014).

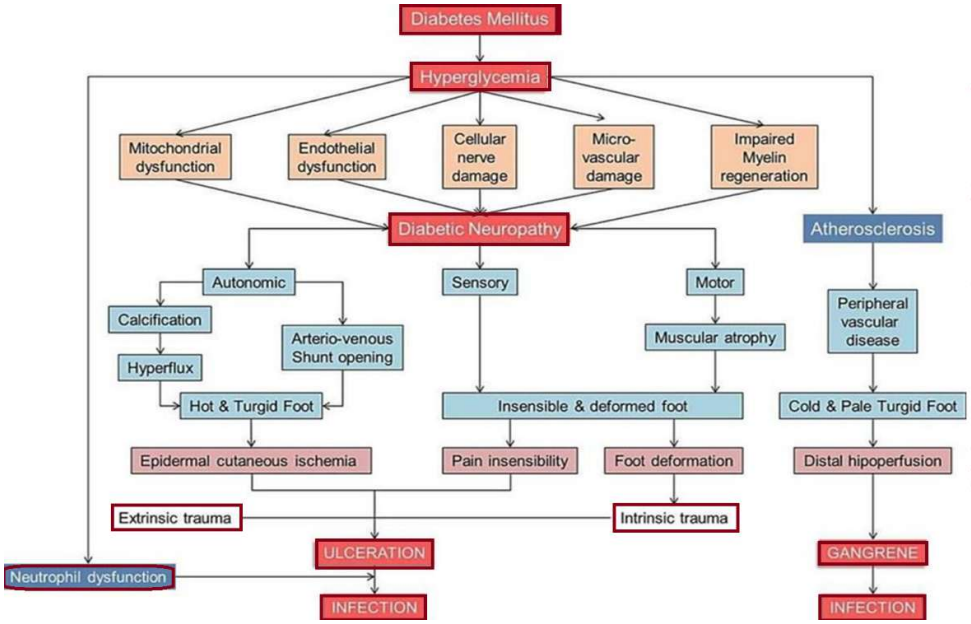


Figure 5. Pathophysiology of Diabetic Foot Ulcer

6. ETIOLOGY

Diabetic foot ulcers have a complex etiology. Poor glycaemic management, calluses, foot deformities, poor foot care, poorly fitting footwear, peripheral neuropathy, poor circulation, dry skin, etc., are some of the prevalent underlying reasons. A foot ulcer will eventually result from neuropathy, which affects about 60% of diabetics. People who have a flat foot are more likely to develop a foot ulcer because their foot experiences excessive stress, which causes tissue inflammation in high-risk locations (Zubair, 2015).

Several components cause the emergence of diabetic foot ulcers in diabetic patients; they are mainly two major factors namely:

1. **Causative factor: a**) peripheral neuropathy, b) high-foot plantar pressure, c) trauma
2. **Contributory factor**: a) atherosclerosis, b) diabetes

7. EPIDEMIOLOGY

The incidence of DFU continues to increase worldwide. Studies showed that 15% of patients with DM will experience complications of DFU in the future. It seems that the prevalence of DFU is not accurately known, and the difference in prevalence rates in each country is estimated at 4-27% of DFU sufferers worldwide (Jalilian et al., 2020).

The prevalence of diabetic ulcer patients in the United States is 15-20%, and the risk of amputation is 15-46 times higher compared with non-DM patients. The prevalence of risk and DFU in Indonesia is estimated high because the undiagnosed DM patients are high either. Diabetic foot is one of the most feared chronic infections of DM, end-stage with disability (amputation) and death. In Indonesia, mortality and amputation rates are still high at 16% and 25% respectively (Mariam et al., 2017).

7.1 World Scenario

Diabetes is one of the most common diseases in almost all countries, and its incidence is increasing due to lifestyle changes that reduce physical activity and promote weight gain. The rise in diabetes has been called the "global epidemic" of the twentieth century and will place a heavy burden on resources and cause poverty for many people, even if it is not prevented (International Diabetes Federation, 2021). The World Health Organization (WHO) estimated that in 2000, approximately 3% of the world's population had diabetes (type 1 and type 2 diabetes, but not gestational diabetes in the blood). WHO also produced projections for 2000 and 2030 using data from 40 countries in addition to the 191 WHO members alone. Another estimate was made by the International Diabetes Federation (IDF). The latest estimate of diabetes prevalence in 2010 is based on data from all 216 United Nations countries (International Diabetes Federation, 2021). In developing countries, most people with diabetes are between the ages of 45 and 64. It is estimated that by 2030, 82 million people in poor countries and more than 48 million in developed countries will have diabetes (Deshpande et al., 2008).

7.2 Indian Scenario

The Indian Council of Medical Research (ICMR New Delhi) conducted the first national study on type 2 diabetes between 1972 and 1975. The prevalence of diabetes was 2.8%. During this period, the number of people over 40 years of age increased by 6.1%, which is surprising in rural areas where health status is poor and health literacy is less (International Diabetes Federation, 2021). A population survey conducted in the Kashmir Valley in 2000 revealed that 1.9% of people over 40 years of age had 'known diabetes'. The National Urban Diabetes Survey (NUDS), a population-based study covering all segments of society in six major cities of India (Delhi, Mumbai, Kolkata, Chennai, Hyderabad, and Bengaluru), included 11,216 participants aged 20 years and above. The age standard of type 2 diabetes is 12.1%. Another study found an age-standardized prevalence of 8.6% in the urban population of Western India (Deshpande et al., 2008). The Prevalence of Diabetes in India Study (PODIS) found that the prevalence of diabetes in India is 2.7% in rural areas, 5.9% in urban areas, and 4.3% of the total Indian population (International Diabetes Federation, 2021). The number of diabetics in India was more than 50 million in 2010, and it is estimated that this number will increase by 1,813 million every year to over 87 million (International Diabetes Federation, 2021).

8. NEUROPATHY

Approximately 60% of diabetic foot infections are caused by diabetes. Metabolic problems caused by hyperglycemia have been shown to cause neuropathy in patients in both animals and in vitro models. The polyol process is one of the most talked-about processes. Hyperglycemic conditions increase the role of sorbitol dehydrogenase and aldose reductase in the development of neuropathy. Therefore, glucose in the body is converted to fructose and sorbitol. As a result of the accumulation of sugar, the brain reduces the amount of myoinositol needed for neuronal transmission. Nicotinamide adenine dinucleotide phosphate stores are important for the production of the vasodilator nitric oxide and the detoxification of reactive oxygen species but are also depleted by the conversion of glucose (Siddiqui et al., 2023; Shanb et al., 2020). As a result, nerves are subjected to greater oxidative stress and vasoconstriction, leading to ischemia and further nerve damage and death. In addition, brain dysfunction and ischemia result from abnormal glycation of neuronal proteins and activation of protein kinase C, which in turn is affected by hyperglycemia and oxidative stress (Clayton & Elasy, 2009).

8.1 Types of Neuropathy

Ischemic Neuropathy:

- Sudden onset, asymmetrical, ischemic etiology, self-limited
- Examples: Mononeuropathy, femoral neuropathy, radiculopathy, plexopathy, cranial neuropathy

Entrapment Neuropathy:

- Gradual onset, usually asymmetric but can be bilateral, compressing etiologic
- Examples: Carpal tunnel syndrome, ulnar entrapment (tennis elbow), lateral cutaneous femoral nerve entrapment

Risk factors for diabetic neuropathy (Siddiqui et al., 2023):

- *Non-modifiable:* Old age, longer duration of diabetes, Hladr3/4 genotype, greater height
- *Modifiable:* Hyperglycaemia, hypertension, elevated cholesterol level, smoking, heavy alcohol use

Vascular Disease

Peripheral arterial disease (PAD) contributes to the development of foot ulcers in up to 50% of patients. The tibial and peroneal nerves of the lower leg are frequently affected. Chronic hyperglycemia causes changes in peripheral arterial smooth cell and endothelial cell function. Contraction is due to a decrease in endothelium-derived vasodilators. In addition, thromboxane A2, a vasoconstrictor and platelet aggregation agonist, is increased by hyperglycemia in diabetic patients, increasing the risk of plasma instability. Arterial lumens may narrow due to changes in the arterial extracellular matrix. Other variables that are also common in diabetics and contribute to the development of peripheral arterial disease (PAD) include smoking, hypertension, and hyperlipidemia. Both can cause arterial occlusive disease when combined, increasing the risk of diabetes and reducing ischemia (Eming et al., 2014).

9. ASSESSMENT OF DIABETIC FOOT ULCERS

In 2008, the American Diabetes Association (ADA) Foot Care Interest Group Task Force published a report outlining the basic principles of foot care. When taking a patient's history, physicians should check for previous cuts or ulcers. The history should suggest symptoms associated with neurologic or peripheral vascular disease. Physicians should ask about other complications of diabetes, such as retinopathy and vision loss, which may indicate kidney disease, especially if the patient is on dialysis or has had a kidney transplant. Finally, patients should be asked about their smoking habits, as smoking has been associated with the development of neurologic and vascular disease (Boulton et al., 2018). A good medical history will help determine your risk of developing foot disease. It is recommended that a barefoot examination be performed in an area with good lighting. The examination should include an examination of your shoes, as poorly fitting shoes can cause foot pain. When foot symptoms occur, the examiner should look for disease or symptoms in the toe. Pay attention to any abnormalities or calluses on your nails. In addition, temperature differences in the feet may be a sign of vascular disease. The feet should also be checked for deformities (Brown, 2024).

In diagnosing vascular abnormalities in the foot, dorsal and posterior tibial pulses should be palpated and noted for presence. Claudication, hair loss, and pale, thin, shiny, or cool skin are signs of central ischemia. If there is concern for vascular disease, the ankle-brachial index (ABI) can be measured in the outpatient setting to determine if the vascular disease is present and whether a vascular disease referral is warranted (Boulton et al., 2018). ABI is obtained by measuring the systolic blood pressure in the calf (dorsal and posterior tibial pathway) and arm (humeral pathway) with a handheld Doppler and then calculating the ratio. A ratio below 0.91 indicates a discrepancy. However, in patients with calcification, those who do not

maintain a good vessel or those with aortic stenosis, ABI may be difficult to develop (Yazdanpanah, 2015). The diagnostic tool used in the diagnosis of diabetic foot is the 10g monofilament. Monofilaments were tested on the appearance of the toes, the sole, and on different parts of the toe abruptly. If the machine cannot feel the monofilament when squeezed by the foot with enough weight to bend the filament, the test is considered sharp in terms of ulcer risk. The calloused area should not be tested (Boulton et al., 2018).

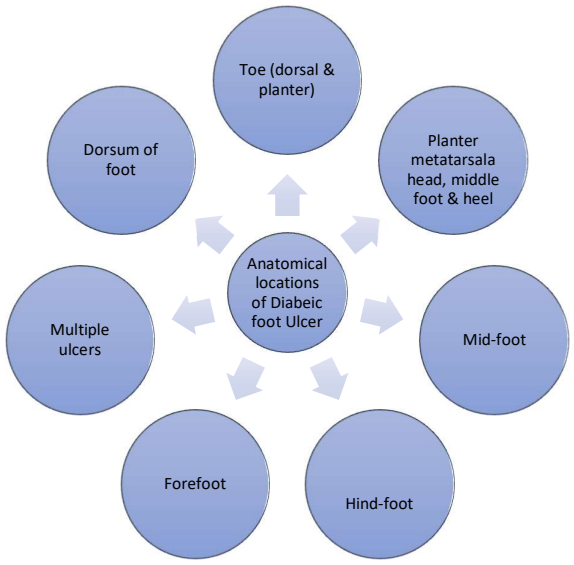


Figure 6 Anatomical location of Diabetic foot ulcer.

10. TREATMENT OF DFU

The primary management goal for DFU is to obtain wound closure as expeditiously as possible.[47]

10.1 Pharmaceutical treatment;

Table 2. Pharmaceutical formulations for Diabetic Foot Ulcer

Types of therapy	Pharmaceutical form	Advantages on DFU	Route of Administer Action	Limitation
Becalplermin	Gel	Stimulates different growth factors useful in the treatment of DFU	Topical	half-life and cancerous effect of API drug
Cell therapy	Injection or gel	Stimulates different cellular mechanisms for regeneration of chronic wound	Locally	Short half-life time

Collagenase	Ointment	Easy application, minimal blood loss& proliferation Of endothelial tissue	Topical	Burning exudations, and inflammation
Deferoxamine	Injectable	Reduction of ulcer area in less time	Locally	Lifetime is short
Derma space system	Device	Stimulates the wound mechanically, for the removal of damaged tissue	Local Shock Waves	Secondary side effects (pain & bruises etc)
Granulox	Spray	Accelerating the healing of the chronic wound	Topical	Short half-life time
Piperacillin/ tazobactum	Injectable	Wide spectrum advantages in infection and low nephrotoxicity	Locally	The adverse reaction may include diarrhoea.

Table 3 Overview of dressing type used in the treatment of diabetic foot ulcer.

Dressing Type	Description	Suggestion for use
Alginates	Highly absorbent with bacteriostatic and haemostats.	Useful in cavitating lesions.
Foam dressing	Moderately absorbent with thermal insulation properties.	Used in Light and heavy exudative wounds.
Hydrogels	Absorbent, donates liquid and aids autolysis.	Useful for dry, sloughy, necrotic wounds. Avoid in concurrent/suspect ed infections.
Iodine Preparations	Moderately absorbent with antiseptic properties.	Discolour wound. Avoid in case of iodine allergy, pregnancy or thyroid disease.
Low-adherence	Minimally absorbent with hypoallergenic properties.	Standard diabetic ulcer treatment. Often use in conjunction with anti-microbials
Silver-impregnated	Absorbent with anti-septic properties.	Useful for infected diabetic foot ulcer. Avoid in known sensitivities to silver

10.2 Systemic Treatment

The importance of patients with DFU is to control diabetes systematically. Nutritional management and blood sugar control are very influential for the patient's recovery (Yazdanpanah, 2015).

Blood Sugar Control: Historically, inadequate blood sugar control can induce foot ulcers to limb neuropathy.

10.3 Local Treatment Dressing

There are lots of types of dressing used in DFU. However, dressings usually tend to be applied by general practitioners based on professional experiences or preference more than based on evidence-based study (Murphy & Evans, 2012).

10.4 Offloading

Lower limb neuropathies lead to the development of foot shear or broken skin. It is due to increased pressure in the same site of the plantar foot and neglected by diabetic patients (Lim et al., 2017).

10.5 Oxygen-Ozone Treatments

Oxygenation is important for wounds in order to improve healing outcomes. In DFU, tissue hypoxia due to lack of peripheral oxygenation is noted in problems of wounds. Ulcer tissue oxygenation is essential and might influence the healing outcome (Murphy & Evans, 2012).

10.6 Nutrition to Promote Wound Healing

The chronic wound needs a lot of resources in daily routines to promote wound healing including nutritional support. Nutritional support is essential in DFU, as during the wound healing process tissue demands more energy. Energy and protein usually become the main resources for building new cells (Seth et al., 2024).

10.7 Ischemic Preconditioning (IPC)

Performing IPC in healthy patients proved to demonstrate the augmentation potential of blood endothelial progenitor cells. Moreover, IPC showed mobilized stem cells which improved wound healing (Murphy & Evans, 2012).

11. ASSESSMENT OF DFU

Nowadays, the number of complications in diabetes involving DFU is high. However, general practitioners tend to ignore assessing diabetic patients regarding its complications. Less than 50% of diabetic patients reported that they received proper assessment according to DFU. Based on the literature, there are two kinds of assessment for DFU: risk assessment and wound assessment (Boulton et al., 2018).

11.1 Risk Assessment

Several assessment tools have been developed to measure the risk factors of DFU regarding neuropathy.

11.2 Neuropathic Assessment

Several articles mentioned that the Neuropathy Symptom Score (NSS) has proven a valid and sensitive tool to assess neuropathy. The NSS tool assesses the foot according to

sensation, whether both feet can determine burn, tingling, pain, and locate its location (Siddiqui et al., 2023).

11.3 Wound Assessment

General practitioners including nurses have to monitor DFU progress to evaluate whether specific interventions are effective or not. Some tools developed to measure wound healing in DFU include the PUSH tool (Pressure Ulcer Scale for Healing). The PUSH tool, which was developed by the National Pressure Ulcer Advisory Panel (NPUAP), was actually created for the purpose of monitoring the growth

12. COMPLICATIONS OF DFU

Diabetic foot ulcer is one of the most significant complications of diabetes and is associated with multiple risk factors. The development of DFU increases:

- Risk of developing foot infections
- Prolonged healing time
- Poor quality of life
- Gangrene
- Lower limb nontraumatic amputation

It is hoped that early changes in the disease may reduce the rate of relapse. All people with diabetes should have their feet examined at least once a year to determine whether they are ill. Patients should be taught the importance of good glycemic control, proper footwear, injury prevention, and self-examination (Boulton et al., 2018).

13. PREVENTION OF DFU

Three criteria identify those at the greatest risk of DFU – previous ulceration, LOPS (unable to feel a 10g monofilament), and at least one absent foot pulse. People with previous foot ulceration are 6.5 times more likely to develop a DFU, with a 40% risk of DFU recurrence at 12 months after the first ulcer (Lim et al., 2017). Moderate, safe, and regular physical activity may protect against first and recurrent DFU. Physical inactivity, non-adherence with recommended footwear, depression, and social isolation increase the risk of recurrent ulceration, while depression, delayed help-seeking, and non-adherence with offloading treatments are associated with delayed healing. Education may be important in DFU healing and future ulcer prevention, but studies have failed to confirm this. Outcome monitoring for specialist teams can be useful, provided that data collection does not detract from care delivery (Brown, 2024).

13.1 Diabetes-Related Foot Ulcers – Detailed Advice for Primary Care

Explain the importance of primary care and community groups in identifying people at risk of diabetic foot disease, how to diagnose the condition when it occurs, and progress in involving the specialist team within 14 days of starting practice (Brown, 2024). The International Diabetic Foot Study Conference has published public health/metabolic guidelines and reviews that provide specific recommendations on the prevention of foot disease, foot examination, personal care tips, footwear selection, and more by 2024. Taken together, this review and decision should serve as a call to action to review the guidance and how we test for diabetes, investigate and monitor diabetic foot disease, and ensure that we work closely with our community diabetes teams (Boulton et al., 2018).

Table 4 Different kinds of debridement for patients with a diabetic foot ulcer.

Method	Explanation	Advantages	Disadvantages
Surgical or Sharp	The callus and all nonviable soft tissues and bone are removed from the open wound with a scalp, tissue nippers, curettes, and curved scissors. Excision of necrotic tissues should extend as deeply and proximally as necessary until healthy, bleeding soft tissue and bone are encountered.	Only requires sterile scissors or a scalpel, so is cost-effective	Requires a certain amount of skill to prevent enlarging the wound.
Mechanical	This method includes wet-to-dry dressing, high-pressure irrigation, pulsed lavage, and hydrotherapy, and is commonly used to clean wounds before surgical or sharp debrid ement	Allows removal of hardened necrosis	It is not discriminating and may remove granu lating tissue it may be painful for the patients
Autolytic	This method occurs naturally in a healthy, moist wound environment when arterial perfusion and venous drainage are maintained.	It's cost-effective. It is suitable for an extremely painful wound.	It's time-consuming and may require an equal amount of time for treatment.
Enzymatic	The only formulation available in the United Kingdom contains Streptokinase and Streptodornase (Varidase Topical Wyeth Laboratories). This enzyme aggressively digests the proteins fibrin, collagen, and elastin, commonly found in a wound's necrotic exudate.	They can be applied directly to the necrotic area	Streptokinase can be systemically absorbed and is therefore contraindicated in patients at risk of an MI it's expensive.
Biological	Sterile maggots of the green bottle fly are placed directly into the affected area and held in place by a closed net dressing. The larvae have a ferocious appetite for necrotic material while actively avoiding newly formed healthy tissue.	They discriminate between the necrotic and the granulating tissue	There may be a reluctance to use this treatment because patients and clinicians it's expensive

Avoidance is the main treatment method for solving the lower level problems of diabetes. There is increasing evidence that foot care management is used to support diabetic foot care in the community, and there is evidence that it reduces both the risk of hospital admission and the prevention of withdrawal from treatment (Brown, 2024)

Table 5 Risk stratification for the assessment of the risk of developing a diabetic foot problem or risk of future amputation.

Low risk	Moderate risk	High risk
No risk factors present	Deformity	Previous ulceration
Presence of callus formation alone	Neuropathy	Previous amputation
	Non-critical limb ischemia	Or renal replacement therapy
		Neuropathy and non-critical limb ischemia
		Neuropathy with callus and/ or deformity
		Non-critical limb ischemia with callus/ or deformity

Table 6 Clinical examination of the diabetic foot and risk stratification.

Examination of the patient's feet should include.
Testing of foot sensation using 10-g monofilament or vibration.
Palpation of foot pulses
Inspection for any foot deformity and footwear
Based on this the foot should be classified as
At the low current risk
At increased risk
High risk
Acute foot / ulcerated food / Charcot

14. MANAGEMENT OF DIABETIC FOOT ULCERS

14.1 Glycaemic Control

There is increasing evidence that tight glycemic control in insulin-dependent diabetics may delay the onset and reduce the progression of diabetic retinopathy, nephropathy, and neuropathy. Diabetic retinopathy increases the development of nephropathy and neuropathy. Callaghan et al. analyzed the effects of tight glycemic control on diabetic neuropathy and found that better glycemic control reduced the risk of neuropathy, particularly in type 1 diabetes (Van Dijk & Van Loon, 2015).

14.2 Pharmacological Therapy

Silent self-education, advancement of diabetes knowledge, and self-management improved oral diabetes medication use in a pilot study. The American Clinical Legend Foundation lists duloxetine and pregabalin as first-line treatment for pain. Atherosclerotic factors should help reduce the risk of concurrent peripheral vascular disease or lower extremity ischemia. The most important measures include smoking cessation and the use of medications such as nicotine replacement, statins, and antiplatelet drugs. Diabetic foot infections with concomitant infections also appear to benefit from intensive culture-based antibiotic therapy. Depending on the severity of the underlying disease, the treatment period may extend from two weeks to two months (Yazdanpanah, 2015).

14.3 Improving Vascularisation

Revascularisation of critically ischaemic legs results in increased perfusion after the procedure, which in turn is associated with a further reduced amputation rate (Lim et al., 2017).

14.4 Debridement

The severity of diabetic foot is due to the preparation of the callus. In this case, necrotic tissue and hyperkeratotic drainage in the wound or deep wound in the form of bacteria will help the wound heal. Deep wounds, especially those of bone and delicate tissue, require more intensive care, some of which include surgery. A 10-year study of wound care practices and collaboration by a multidisciplinary team found that reducing the number of diabetic discharges could be achieved by an "offloading" approach with time reporting. A controlled trial of walking casts for diabetic feet showed positive results; "full contact casts" recorded the most significant offloading (Yazdanpanah, 2015).

14.5 Silver-Impregnated Dressings

Silver-impregnated dressings are not more effective in treating diabetic foot ulcers in randomized controlled trials than dressings for treating any other wound (Murphy & Evans, 2012).

14.6 Negative Pressure Wound Therapy

Targeted negative pressure wound therapy is another increasingly common method used in the management of diabetic foot ulcers primarily involving the removal of wound fluid through a sealed vacuum. This is aimed at improving tissue perfusion and in the promotion of the formation of granulation tissue, and often results in shorter treatment in comparison with ulcers treated with traditional gauze dressing. However, a Canadian evidence-based study revealed no statistically significant difference ($p = 0.15$) between negative pressure wound therapy and standard wound care in the length of time to complete wound closure (Murphy & Evans, 2012).

14.7 Maggot Therapy

The use of maggot therapy primarily functions by removing dead necrotic tissue leaving healthy granulation tissue on the wound bed. In a meta-analysis of four studies comparing maggot debridement therapy with standard therapy on 356 participants, Tian et al. demonstrated a more rapid growth of granulation tissue and greater wound healing rate ($p = 0.0004$), and an increase in many antibiotic-free days (126.8 ± 30.3 days vs. 81.9 ± 42.1 days; $p = 0.001$) as compared to standard wound care (Murphy & Evans, 2012).

14.8 Growth Factors and Skin Substitutes

Studies on physiological stimulators of wound healing provide additional evidence that improvements in several growth variables are possible, including platelet-derived growth variables, epidermal growth count, and transforming growth factor beta, all of which are thought to play an important role in the cell growth process. Becaplermin is a combination of platelet-derived growth factors that is currently commercially available (Murphy & Evans, 2012). Evaluating the evidence for the use of artificial substrates and skin grafts in the treatment of diabetic foot ulcers showed that the combination of treatments resulted in better and shorter overall wound closure. Subsequent studies have also shown that the use of granulocyte colony stimulation may reduce the overall reduction in the resection rate of diabetic foot ulcers, thereby reducing the need for surgery. However, further studies are needed to confirm these findings and identify the population that would benefit most from this treatment (Murphy & Evans, 2012).

14.9 Multidisciplinary Team Initiative

The management of diabetic foot complications requires collaboration among different individuals within the management team to ensure the management of multiple perspectives on diabetes care. Diabetic foot ulcer patients receiving care from the Diabetic Foot Care Core Group have better treatment outcomes and a reduced risk of progression to the right pathology. This professional team usually, but not always, consists of a hematologist, a medical doctor, a microbiologist, a tissue doctor, an orthopedic doctor, and a vascular surgeon with a deep understanding of movement. This is primarily due to its effect on glycemic control and weight control, improved renal function patterns, and the significant impact of diabetic retinopathy on prognosis. Additionally, error communication of results supported by feedback from the collaborative team is effective in reducing minor and major retractions (Boulton et al., 2018).

15. TOP 5 FOOT CARE TIPS TO PREVENT DIABETIC FOOT ULCERS

Along with controlling your blood glucose levels, these basic foot care tips can help reduce your risk of foot ulcers and improve your overall health (Boulton et al., 2018).

15.1 Inspect your feet every day

You may not have the flexibility to see the bottoms of your feet, or you may not see well. If this is the case, have your spouse or a family member inspect your feet and shoes for cuts, bruises, cracks, blisters, redness, or other signs of an abnormality. Call your doctor if you notice even a small wound – the earlier we can help, the better.

15.2 Show your doctor your feet

Remove your shoes and socks when you visit your primary care doctor. Ask them to examine your feet for nerve damage and circulation, even if they don't initiate the request. New cooling insoles developed by UTSW scientists reduce foot temperature, diminishing the risk of diabetic foot ulcers.

15.3 Wear shoes and socks all the time, even in the house

If you have diabetic neuropathy, you might not feel it if you step on something sharp. Special shoes and insoles can help protect your skin from developing ulcers. Inspect your shoes before you put them on, and get new shoes regularly.

15.4 Choose properly fitting shoes

Avoid pointed toes, high heels, or shoes that are too tight, loose, or short. Your doctor can prescribe stylish, custom-fitted shoes or insoles that are designed specifically for people who are at high risk of developing foot complications.

15.5 Use an infrared thermometer to see if you have diabetic hot feet

An unknown injury can cause foot pain. This device can detect the "burning" pain in your feet. Skin temperature often rises by 4 degrees Fahrenheit or more in the days or even weeks before the disease appears. Take readings on different parts of your feet to look for changes. If you notice a temperature increase of 4 degrees Fahrenheit, call your doctor (Boulton et al., 2018).

16. SURGICAL OPTIONS FOR DIABETIC ULCERS

As podiatrists, we consider future foot function along with wound healing. If surgery is right for you, we will recommend a procedure that treats your pain or infection now so you can move more easily and with less pain (Boulton et al., 2018).

Procedures we might discuss include:

- **Debridement** to remove dead or infected skin and tissue from the wound, which encourages healing
- **Skin grafts** to reconstruct weakened or missing skin, which promotes healing and helps reduce the risk of infection
- **Vascular surgery**, which helps restore proper blood flow to the wound site, promoting healing and healthier skin
- **Shaving or removing bone** to correct deformities that put pressure on the surrounding area, such as hammertoes, bone spurs, or bunions
- **Reconstruction of deformities** such as flat or high-arched feet, which can cause areas of high pressure
- **Realigning or fusing joints** to address biomechanical defects that increase pressure
- **Lengthening tendons** to release tension and take pressure off an ulcer, allowing it to heal, or prevent a new one from forming

- **Amputation of a toe or the foot** if tissue is severely damaged or an infection will not stop spreading. Our limb salvage team exhausts all other options before recommending amputation

Patients who have the most success after surgery are typically those who make a game plan for recovery. Your doctor will talk with you about what to expect before, during, and after your procedure. For example, you may need to have someone stay with you for a few days or help with errands, depending on the procedure. Long term, you will need to keep your nutrition, blood sugar levels, and blood flow on track to reduce the risk of recurrence. Your care team will work with you to make manageable changes to support your long-term health goals (Boulton et al., 2018).

17. DIABETIC FOOT SELF-CARE

If you are suffering from diabetic foot conditions, there are several things you can do to alleviate symptoms and care for skin conditions (Brown, 2024):

- Try to keep your skin clean and dry
- Avoid very hot baths and showers. If your skin is dry after bathing, don't use bubble baths. It is best to use moisturizing soap to relieve dry skin
- After bathing and showering, use a standard skin lotion – but don't apply between the toes. The extra moisture between the toes may encourage fungus growth
- Dry skin prevention is essential. When skin becomes dry and itchy, it may promote scratching which can allow infections to set in. Moisturize your skin to prevent chapping, especially in cold or windy weather
- Treat cuts and scrapes immediately and wash minor cuts with soap and water. Only use an antibiotic cream or an ointment if your physician approves. Cover minor cuts with sterile gauze
- During winter and dry months, keep the home more humid, if possible, to prevent drying of the skin. See a specialist for skin problems that cannot be managed
- Check feet daily for sores and cuts
- Establish a daily skincare and foot care routine

Human beings with diabetes are at higher risk of developing foot ulcers. Prolonged and poorly controlled hyperglycemia can cause abnormalities in blood vessels and veins, leading to foot deformities and ulcers (Zubair, 2015). People with diabetes need to have their feet examined at a minimum once every 12 months to identify conditions that might be causing their disease. Treatment plans should be based on the findings and the patient's prognosis. If an infection occurs, treatment should consist of elimination, removal, and use of dressings. The period of infection should be determined by clinical investigation and suitable tissue, and treatment should be based on established culture. If there is evidence of ischemia, revascularization may be accomplished to reconstruct blood vessels and increase the danger of complications within the limb (Lim et al., 2017). In most patients, there are extra treatments that could help the wound. The danger of growing ulcers and related diseases may be reduced by periodic foot investigations in diabetic patients and by deciding to take part in appropriate and specialized care, offering health and economic advantages to sufferers, households, and society (Brown, 2024).

It is obvious that nutrition is influential in wound healing, and some key nutrients increase their benefits to aesthetic consequences. Several research studies have shown associations between nutritional deficits and suboptimal wound restoration effects. However, the current corpus of evidence remains rather generalized. More observational cohort studies and randomized controlled trials are required to envision correlations among various vitamins and their results on wound recuperation and aesthetic outcomes (Seth et al., 2024).

Diabetic foot ulcers are a devastating factor in diabetes development affecting about 15% of patients with diabetes. The underlying pathophysiology of diabetic foot ulcers is a complex interplay among the body's chronic hyperglycaemic state and that of neuropathic, vascular, and immune system components (Alavi et al., 2014). Preventative strategies in the form of patient education and regular foot assessments for peripheral vascular disease and neuropathy alongside risk stratification form the basis of the management of diabetic foot disorder. However, a combination of several treatment modalities can also be facilitated by the multidisciplinary team for people with more complicated diabetic foot headaches (Boulton et al., 2018).

18. CONCLUSION

This review article comprehensively explains the theory related to diabetic foot ulcers with prevalence, complication, amputation rate, economic and health burden, and prevention measures with statistical conditions for DFU. Commonly DFUs are of two types that are explained in this article: neuropathic and neurochemical ulcers. DFUs are classified in the degree of DFU like grade 0, I, II, III, IV, V and lesion in diabetic mellitus as Wagner Diabetic foot with grade 0,1,2,3,4,5. The pathway of DFU was explained on the basis of the type of neuropathy which is based on the nervous system of the human body (Alavi et al., 2014; Clayton & Elasy, 2009).

This review covers pathophysiology, etiology, and epidemiology, with world scenario and Indian scenario, diabetes neuropathway, and vascular disease with an assessment of DFU related to the anatomical location of DFU (Deshpande et al., 2008; International Diabetes Federation, 2021). The treatment of DFU related to pharmaceutical formulation and treatment therapy like Becalplermin, cell therapy, collagenase, deferoxamine, derma space system, granulox, piperacillin/tazobactam, and dressing type used in the treatment of DFU, and formulation like alginates, foam dressing hydrogel, iodine preparations, low adherence, and silver-impregnated (Murphy & Evans, 2012). The field of wound care is ever-expanding with advances in technology. While there is still no superior substitute for reconstruction using patients' own tissues and carefully thought-out reconstructive procedures, new products can help facilitate eventual healing by providing prophylaxis against barriers to healing, augmentation of wound healing factors, assistance in temporizing and bridging time to definitive repair, and optimization of the ultimate results of wound reconstruction (Murphy & Evans, 2012).

This review covers the treatment of DFU like systemic, blood sugar control, local treatment dressing, offloading, oxygen-ozone treatment, and nutrition to promote wound healing, ischemic preconditioning (IPC) with assessment like risk assessment, neuropathic assessment, wound assessment, related to complications of DFU (Yazdanpanah, 2015). This review about the prevention of DFU, diabetes, and related foot ulcers, detailed advice for primary cases, and different kinds of debridement for patients with a diabetic foot ulcer has been explained with risk stratification for the assessment of the risk of developing a diabetic foot problem or risk of future amputation account with clinical examination of the diabetic foot and risk stratification (Brown, 2024; Boulton et al., 2018). Finally, management of diabetic foot ulcer review covers glycaemic control, pharmacological therapy, improving vascularisation, debridement, silver impregnation, negative pressure wound therapy, maggot therapy, and diabetic foot self-care (Lim et al., 2017; Murphy & Evans, 2012).

A literature search was undertaken in Scopus, PubMed, Elsevier, MEDLINE, Embase, UpToDate, and Google Scholar. Observational studies that assessed the severity of DFU were included. The data extraction and assessment are based on PRISMA.

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