Role of community pharmacist in management and prevention diabetic foot ulcer and infections

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Abstract

Pharmacist plays an important role in patients healthcare. Pharmacist is now becoming more patient oriented than product oriented and have brought many changes in life of patients. There are considerable evidence that patients counseling enhances patient compliance and improve the quality of life outcomes in diabetic foot ulcers. Diabetic foot ulcer is one of the major complications of Diabetes mellitus. It occurs in 15% of all patients with diabetes and precedes 84% of all lower leg amputations. Sharp debridement and management of underlying infection and ischemia are also critical in the care of foot ulcers. Prompt and aggressive treatment of diabetic foot ulcers can often prevent exacerbation of the problem and eliminate the potential for amputation. The aim of therapy should be early intervention to allow prompt healing of the lesion and prevent recurrence once it is healed. Multidisciplinary management programs that focus on prevention, education, regular foot examinations, aggressive intervention, and optimal use of therapeutic footwear have demonstrated significant reductions in the incidence of lower-extremity amputations. Community Pharmacist play vital role Patient education regarding foot hygiene, nail care and proper footwear is crucial to reducing the risk of an injury that can lead to ulcer formation. Diabetes currently affects more than 194 million people worldwide and is expected to reach 333 million by 2025,with the maximum burdens falling upon developing countries. India considered as “Diabetic capital of the world”, alone currently counts over 35 million peopleharbouring diabetes. This is estimated to touch 73.5million by 2025 as a consequence of longer life expectancy, sedentary lifestyle and changing dietary patterns.

Key words- Diabetic foot ulcer , patients counseling , Diabetic capital , community pharmacist .

Introduction

A diabetic foot ulcer is an open sore or wound on the foot of a person with diabetes. Because of loss of pain sensation, it is usually not painful.. Foot ulcers are a significant complication of diabetes mellitus and often precede lower-extremity amputation. Among persons with diabetes,

15% develop diabetic foot ulcers (DFUs) during their lifetimes. Currently, 3-4% of individuals with diabetes have deep infections or DFUs.The most frequent underlying etiologies are neuropathy, trauma, deformity, high plantar pressures, and peripheral arterial disease. Thorough and systematic evaluation and categorization of foot ulcers help guide appropriate treatment.Diabetic ulcers are the most common foot injuries leading to lower extremity amputation. Family physicians have a pivotal role in the prevention or early diagnosis of diabetic foot complications. Management of the diabetic foot requires a thorough knowledge of the major risk factors for amputation, frequent routine evaluation and meticulous preventive maintenance. The most common risk factors for ulcer formation include diabetic neuropathy, structural foot deformity and peripheral arterial occlusive disease. A careful physical examination, buttressed by monofilament testing for neuropathy and noninvasive testing for arterial insufficiency, can identify patients at risk for foot ulcers and appropriately classify patients who already have ulcers or other diabetic foot complications. Patient education regarding foot hygiene, nail care and proper footwear is crucial to reducing the risk of an injury that can lead to ulcer formation. Adherence to a systematic regimen of diagnosis and classification can improve communication between family physicians and diabetes subspecialists and facilitate appropriate treatment of complications. This team approach may ultimately lead to a reduction in lower extremity amputations related to diabetes. Nerve damage due to diabetes causes altered or complete loss of feeling in the foot and/or leg. This is known as peripheral neuropathy. Pressure from shoes, cuts, bruises, or any injury to the foot may go unnoticed. The loss of protective sensation stops the patient from being warned that the skin is being injured and may result in skin loss, blisters and ulcers.Vascular disease is also a major problem in diabetes and especially affects very small blood vessels feeding the skin (microangiopathy). In this situation a doctor may find normal pulses in the feet because the arteries are unaffected. However other diabetic patients may also have narrowed arteries so that no pulse can be found in the feet (ischaemia). The lack of healthy blood flow may lead to ulceration. Wound healing is also impaired. Diabetic foot ulcers are sores on the feet that occur in 15% of diabetic patients some time during their lifetime. The risk of lower-extremity amputation is increased 8-fold in these patients once an ulcer develops. Standard therapy involves the use of dressings to protect the wound bed from trauma and to absorb exsudate, offloading of high pressure on the wound bed e.g. by prescribing protective footwear, and wound bed preparation to accelerate endogenous healing and to facilitate the effectiveness of topically applied substances. But these measures are often deficient to heal all diabetic ulcers when the patient's own intrinsic wound healing system is insufficient. In this group of patients skin replacement therapies are second line treatment options. When treating diabetic foot ulcers it is important to be aware of the natural history of the diabetic foot, which can be divided into five stages: stage 1, a normal foot; stage 2, a high risk foot; stage 3, an ulcerated foot; stage 4, an infected foot; and stage 5, a necrotic foot. This covers the entire spectrum of foot disease but emphasises the development of the foot ulcer as a pivotal event in stage 3, which demands urgent and aggressive management. Diabetic foot care in all stages needs multidisciplinary management to control mechanical, wound, microbiological, vascular, metabolic and educational aspects. Achieving good metabolic control of blood glucose, lipids and blood pressure is important in each stage, as is education to teach proper foot care appropriate for each stage. Ideally, it is important to prevent the development of ulcers in stages 1 and 2. In stage 1, the normal foot, it is important to encourage the use of suitable footwear, and to educate the patient to promote healthy foot care and footwear habits. In stage 2, the foot has developed one or more of the following risk factors for ulceration: neuropathy, ischaemia, deformity, swelling and callus. The

majority of deformities can be accommodated in special footwear and as callus is an important precursor of ulceration it should be treated aggressively, especially in the neuropathic foot. In stage 3, ulcers can be divided into two distinct entities: those in the neuropathic foot and those in the neuroischaemic foot. In the neuropathic foot, ulcers commonly develop on the plantar surface of the foot and the toes, and are associated with neglected callus and high plantar pressures. In the neuroischaemic foot, ulcers are commonly seen around the edges of the foot, including the apices of the toes and back of the heel, and are associated with trauma or wearing unsuitable shoes. Ulcers in stage 3 need relief of pressure (mechanical control), sharp debridement and dressings (wound control), and neuroischaemic foot ulcers may need vascular intervention (vascular control). In stage 4, microbiological control is crucial and severe infections need intravenous antibacterial therapy, and urgent assessment of the need for surgical drainage and debridement. Without urgent treatment, severe infections will progress to necrosis. In stage 5, necrosis can be divided into wet and dry necrosis. Wet necrosis in neuropathic feet requires intravenous antibacterials and surgical debridement, and wet necrosis in neuroischaemic feet also needs vascular reconstruction. Aggressive management of diabetic foot ulceration will reduce the number of feet proceeding to infection and necrosis, and thus reduce the number of major amputations in diabetic patients. Adherence to a systematic regimen of diagnosis and classification can improve communication between family physicians and diabetes sub specialists and facilitate appropriate treatment of complications. This team approach may ultimately lead to a reduction in lower extremity amputations related to diabetes. Foot-care education combined with increased surveillance can reduce the incidence of serious foot lesion.

Causes of diabetic foot ulcer

The chain of events leading to the development of diabetic foot ulcers has been well-characterized and involves a variety of factors. In general, the most common precipitating event is trauma to the foot of a person with diabetes. Examples of foot trauma that can predispose a person to develop a diabetic foot ulcer include:

- Irritation to the foot caused by poorly-fitting shoes
- Calluses that are left untreated
- Burn injury to the foot
- Cut (laceration) of the foot
- Penetrating injury to the foot from a sharp object
- Insect bite to the foot

In addition to trauma, there are two other conditions that predispose diabetic patients to develop diabetic foot ulcers:

- Peripheral neuropathy - Damage to the peripheral nerves from diabetes that leads to sensory, motor, or autonomic nerve dysfunction has been estimated to be a causative factor in about 90% of diabetic foot ulcers.
- Peripheral vascular disease - Many people with diabetes suffer from peripheral vascular disease which reduces the blood flow to the lower extremities resulting in tissue*ischemia* (inadequate blood flow to an area of the body) which is a recognized risk factor development of diabetic foot ulcers. Peripheral vascular disease has been estimated to be a major causative factor in about 35% of diabetic foot ulcers.
- Infection - Once an area of the skin protecting the foot has been broken, usually as a result of some type of trauma, bacteria enter the wound triggering a complex chain of

events that can lead to infection. There are three well-recognized patterns of infection in diabetic foot ulcers:

- Superficial - infection that is localized or limited to the superficial layers of the skin
- Cellulitis - infection that has spread to the deeper layers of the skin (subcutaneous or connective tissue)
- Osteomyelitis - infection that has spread to the underlying osseous tissue (bone).

Because normal wound healing is impaired in people with diabetes, without prompt diagnosis and treatment, a superficial (localized) skin infection can quickly spread to the deeper layers of the soft-tissue (cellulitis) and then further spread to the underlying bone (osteomyelitis). The risk for amputation of the infected limb increases significantly once the infection has reached the underlying bone.

Pharmaceutical care of diabetic foot ulcer patients

Community pharmacist play important role in Prevention is the best way to avoid dealing with diabetic foot ulcers. Proper foot care and attention to cuts, abrasions and blisters as they arise can prevent serious wounds from forming. If you suffer from peripheral neuropathy, it is particularly important to take care of your feet.

Foot ulcers in diabetes require multidisciplinary assessment, usually by diabetes specialistsand surgeons.consistsofappropriatebandages, antibiotics (against staphylococcus, streptococcus and anaerobe strains), debridement and arterial revascularisation.It is often 500 mg to 1000 mg of flucloxacillin, 1 g of amoxicillin and also metronidazole to tackle the putrid smelling bacteria. Specialists are investigating the role of nitric oxide in diabetic wound healing. Nitric oxide is a powerful vasodilator, which helps to bring nutrients to the oxygen deficient wound beds. In 2004, The Cochrane review panel concluded that for people with diabetic foot ulcers, hyperbaric oxygen therapy reduced the risk of amputation and may improve the healingat 1 year. They also suggest that the availability of hyperbaric facilities and economic evaluations should be interpreted. Diabetic foot ulceration represents a major medical, social and economic problem all over the world. While more than 5% of diabetic patients have a history of foot ulceration, the cumulative lifetime incidence may be as high as 15%. Foot infections are among the most serious complications of diabetes, and a leading cause of diabetes-related hospitalizations. The infections typically occur when pathogens-usually gram-positive bacteria-infect foot ulcers. These sores develop because of diabetes-related nerve damage and loss of feeling in the feet. Amputation may be needed when infections fail to respond to therapy. Once a diabetic foot ulcer has been treated and has healed, preventing recurrence of a subsequent ulcer is of utmost importance. The rate of recurrence of diabetic foot ulcers has been estimated to range from 28% at 1-year to nearly 100% at 3 years or longer. The risk of amputation also increases with each recurrence of the ulcer and, therefore, preventing recurrence is a major objective in the management of patients with a history of diabetic foot ulcers.

Treat Foot Injury with First Aid Procedure

- Wash the area that shows injury with a mild antibacterial soap and warm water.
- Put on a mild antiseptic like hydrogen peroxide. Avoid the use of iodine. Instead, apply an antibacterial ointment.

- If needed, cover the injured area with band-aid or sterilized gauze. This should keep the wound free from dirt.
- Allow the wound to heal properly by getting the feet rested. If the affected area becomes painful, red and swollen, do not waste time. Call the doctor right away.

A diabetic foot ulcer may be treated with bed rest. Foot supports can also help. If infected, antibiotics can be used but this should be closely monitored by you and your doctor. We do not want it to get out of control as the consequence is devastating. Diabetic Foot Ulcer and Prevention Diabetic foot ulcer can be prevented by paying close attention to foot care and managing foot injuries properly. Inspect the feet daily by yourself or a caretaker. Clean gently with soap and water and then apply topical moisturizer to keep skin healthy and able to resist injury and breakdown. Get the doctor to inspect the shoes for proper fit and support. Many can use athletic shoes and thick absorbent socks but some may need custom shoes which are now covered by Medicare Part B when the doctor certifies the need. Minor foot problems can be made worse by home remedies so avoid heating pads, hot soaks, and harsh agents like iodine, astringents and hydrogen peroxide. When sugar levels fall for prolonged duration in diabetics it leads to damage of nerves in their feet. This nerve damage leads to loss of sensation in the feet and also several other feet deformities. This nerve damage is also called as peripheral neuropathy.

Foot problems like calluses and hammertoes lead to high pressures on the soles of the feet. Sometimes diabetics hurt their feet wither by a single major trauma or repetitive minor trauma. Single major trauma includes situations like scraping the skin, stepping on some danger objects, placing feet in really hot water, or cutting toenails inappropriately. Repetitive minor trauma includes situations like walking for long.In case of people with diabetes, the blood flow will be poor. This poor blood flow delays the wound healing process. It also increases the risk of infection and foot amputation.

Wear Support Socks

Healthcare professionals sometimes recommend the use of support socks in individuals with the following health conditions:

- Varicose veins
- Spider veins
- Phlebitis
- Deep vein thrombosis
- Post surgical edema
- Pregnancy

Support socks also may be recommended to healthy individuals who travel long distances and must sit for hours at a time. During long airplane trips, for example, due to reduced mobility, blood flow can pool in the legs, resulting in swollen ankles and feet and achy, sore legs. Support socks can help promote blood flow and reduce leg discomfort.

Etiology

Peripheral neuropathy

Peripheral neuropathy affects sensory, motor, and autonomic pathways. Sensory neuropathy deprives the patient of early warning signs of pain or pressure from footwear, from inadequate soft-tissue padding, or from infection. This neuropathy appears in a stocking-glove distribution,

with many patients complaining of burning or searing pain.Optimal control of blood glucose levels decreases the incidence of most diabetes-associated organ system morbidity. The primary risk factor for the development of diabetic foot ulcers (DFUs) is loss of protective sensation, best measured by insensitivity to the Semmes-Weinstein 5.07 (10 g) monofilament . Abnormal white blood cell (WBC) function and the presence of peripheral vascular disease allow wounds to become contaminated and infected by organisms that normally are nonpathogenic. This explains the identification of unusual bacteria from the wounds of patients with diabetes.

Figure- 1. Typical diabetic foot ulcercaused by high plantar pressures at thesecond metatarsal head.

Autonomic neuropathy produces chronic venous swelling. Motor peripheral neuropathy or Charcot arthropathy can produce bony deformity, which, combined with the loss of protective sensation, can result in skin ulceration from pressure or from shear forces. Associated factors are a history of foot infection or ulceration and previous partial or whole-foot amputation. Motor neuropathy leads to muscle weakness and intrinsic muscle atrophy in the hands and feet. Patients with motor neuropathy can develop bunion, claw toe, and hammertoe deformities as a result of muscle imbalance. They lose normal vascular tone and thermal regulation, often developing severe venous swelling that can be managed only with compression hose. Severe tissue swelling can lead to ulceration and infection. The patients develop dry, cracked skin as a result of autonomic dysfunction, with the cracks allowing the entry of bacteria. Nail deformity or pathologic proliferation may make the areas adjacent to the nails foci for skin breaks or for infection.

Vasculardisease

Ischemic peripheral vascular disease is the second risk factor for developing diabetic foot ulcer and infection. This disorder used to be considered a small vessel disease, but current research links the vascular pathology to the basement membrane of the arterial wall. The characteristics of the disease are similar in persons who are diabetic and those who are not, except that its distribution is somewhat more scattered and geographic in persons who are not diabetic, as opposed to being progressive in a distal direction in persons who are diabetic.

Immunodeficiency

The third major risk factor is related to the immune deficiency seen in persons with diabetes. Glycosylated immune proteins lose efficiency, and granulocytes do not perform adequately, leaving these patients prone to infection with organisms that would not affect a healthy host.Each of these potential abnormalities make the diabetic foot susceptible to abnormal mechanical stresses that can lead to a break in the normal soft-tissue envelope. This can initiate a foot infection that cannot be resolved easily.

Pathophysiology

Pressure over a bony prominence has often been cited as the cause for skin breakdown in patients with diabetes. Skin breakdown occurs at far lesser loads when the pressure is applied by shear forces. The accompanying loss of protective sensation prevents the patient from being warned that intolerable loads have been applied. This leads to blister formation and full-thickness skin loss. The process is heightened in the presence of severe venous swelling, which further lowers the injury threshold. Shoes become tight due to swelling, thus increasing the direct pressure and shear forces applied to skin overlying the bony prominence. Thickened, hypertrophic nails increase pressure on the soft tissues surrounding the nails. The common result is tissue failure and ulcer formation.Once the skin barrier is broken, wound healing can be impaired by abnormally functioning WBCs. Moreover, patients often are malnourished. Many have a marginal vascular supply, with less ability to achieve resolution of infection and wound healing.
Tissue around the ulcer may become black due to the lack of healthy blood flow to the foot. In severe cases partial or complete gangrene may occur.

Skin complications of diabetes

Diabetic foot ulcer Diabetic with athlete's foot

Figure-2 Diabetics are also very prone to secondary infection of the ulcer (wound infection) and surrounding skin (cellulitis).

Classification of diabetic foot ulcers

Most experts use some variant of the classification system developed by Wagner and most currently modified by Brodsky.

Table-1 Depth-Ischemia Classification of Diabetic Foot Lesions

Depth Classification	**Definition**	**Treatment**
0	At-risk foot, no ulceration	Patient education, accommodative footwear, regular clinical examination
1	Superficial ulceration, not infected	Offloading with total contact cast (TCC), walking brace, or special footwear
2	Deep ulceration exposing tendons or joints	Surgical debridement, wound care, offloading, culture-specific antibiotics
3	Extensive ulceration or abscess	Debridement or partial amputation, offloading, culture-specific antibiotics
Ischemia Classification		
A	Not ischemic	
B	Ischemia without gangrene	Noninvasive vascular testing, vascular consultation if symptomatic
C	Partial (forefoot) gangrene	Vascular consultation
D	Complete foot gangrene	Major extremity amputation, vascular consultation

It is estimated that about 15% of people with diabetes will develop a foot ulcer sometime during their lifetime. Fortunately, up to 86% of foot ulcers will heal when treated properly. A foot ulcer is defined as a break in the skin or deep sore; they are most often located on the ball of the foot, an area of repeated stress.

If you develop any kind of sore or wound on your feet that doesn't heal in a day or two, it's very important that you see your doctor or foot care specialist right away. Untreated lesions or ulcers can become infected quickly; even when treated, foot ulcers may not heal well in people with diabetes.

Recent developments in diabetic foot ulcer therapy

Doctor may x-ray your feet to make sure the bone is not involved. If the results are not clear, you may have an MRI scan to help your doctor determine the extent of the lesion.

Treatment must address all of the factors involved in wound healing:

- Infection - which stops or delays the normal wound repair process.
- Repeated trauma during the wound healing process - which continually destroys new tissue.

- Decreased blood flow - which reduces the amount of oxygen and nutrients getting to the tissues.

Treat the infection

The doctor will thoroughly clean the wound to remove all infected tissue; in severe cases, this may be done in the operating room. Early, aggressive wound cleaning (called "debridement") has been shown to heal these wounds more rapidly. If there is an infection, your doctor will prescribe antibiotics. If the infection is serious, you may be hospitalized to receive intravenous antibiotics. Dressings are used to prevent further trauma, to minimize the risk of infection, to relieve local pain, and to optimize the environment for healing. A moist wound environment is important for wound healing to occur.

You can help by keeping the area clean and moist at all times and using the medications your doctor has prescribed for you. It's important that you only use the medications your doctor has suggested. People used to use cleansers or antiseptics such as hydrogen peroxide on these types of wounds, but it is now known that they actually delay wound healing. They also dry out the tissue, and it is now believed that a moist environment stimulates more rapid wound healing.

Off-load pressure

Depending on the location of your foot ulcer, you may need to keep pressure off the area. This is called "off-loading" and means avoiding all mechanical stress on the wound so that it can heal. If there is no infection, a total contact cast may be used to relieve pressure. Or your doctor may recommend using "non-weight-bearing" devices such as orthopedic shoes, a walker, crutches, or even a wheelchair or bed rest - these can help healing by relieving pressure on the injured part of your foot. If your doctor has suggested keeping weight off of your foot, it's important to do so. Keep your foot elevated as much as possible.

Improve blood flow

If there is evidence of impaired blood flow to your feet, then your doctor may consider a surgical procedure called "revascularization." This involves bypassing or implanting a graft past lesions in the arteries that are obstructing blood flow. These procedures have been as successful in restoring blood flow for people with diabetes as in others and have been shown to help achieve rapid and durable healing of diabetic foot ulcers. They have also been shown to decrease the need for amputation.

Promote healing

New treatments such as recombinant growth factors and bioengineered skin patches are now available to help improve healing of foot ulcers. Growth factor gels contain a protein that helps the ulcer fill in with healthy tissue, so it heals faster and better than it would otherwise. Human skin cells are processed and grown in the laboratory to produce bioengineered skin, or skin equivalents, which are applied to the foot ulcer to enhance the process of wound healing. Foot care experts are encouraged by the early results of these treatments, which they say "are healing diabetic foot wounds faster and preventing amputations." Used with traditional approaches such as removing pressure, the new high-tech treatments reduce healing time, infection, hospitalization, and amputation while improving the quality of life. They've been called "a

winning combination to reduce the needless number of lower extremity amputations in this country."
Other treatments are sometimes used but, according to the American Diabetes Association, they have not been adequately tested in clinical trials to prove their worth. These include hyperbaric oxygen, electrical stimulation, cold laser, and heat treatments.

Treatment of diabetic foot ulcers
As soon as a foot ulcer is discovered, medical treatment, whether by your family physician or a podiatrist, should begin. Treatment of diabetic foot ulcers reduces the risk for infection and amputation.
Treatment of diabetic foot ulcers includes:

- Taking the pressure off the area. This can be done with special footgear, braces, a wheelchair or crutches.
- Removing dead skin and tissue in the area, called debridement.
- Applying medication or dressings to the ulcer.
- Managing blood glucose levels.

Preventing infection during treatment of diabetic foot ulcers
With treatment of the diabetic foot ulcer underway, patients can do the following to keep the ulcer from becoming infected:

- Continue to control blood glucose levels. This enhances healing and reduces the risk for complications.
- Keep the ulcer clean and properly bandaged. Researchers continue to investigate the use of growth factors, ulcer dressings and skin substitutes, which have been shown to be highly effective in the treatment of diabetic foot ulcers.
- Clean the wound daily, as per physician directions.
- Keep the feet covered. Research has shown that wounds and ulcers heal faster, with a lower risk for infection, if they are kept covered.

Healing time of foot ulcers ranges from weeks to months. A variety of factors impact healing time, including wound size and location, pressure on the wound, swelling, circulation, blood glucose levels, wound care, and medication and other therapies used.

Surgical treatment of diabetic foot ulcers
Most noninfected foot ulcers do not require foot surgery. However, when standard treatments fail, surgical treatment of diabetic foot ulcers may be necessary. Surgical treatment of diabetic foot ulcers may include procedures to remove pressure on the ulcerated area through bone shaving as well as the correction of foot deformities that may be contributing to the creation of the ulcer, including hammertoes and bunions.
diabetics when blood sugar levels are abnormally high it is a common phenomenon that they get sore or wounds. These sores and wounds are commonly called as diabetic foot ulcers. Sometimes these ulcers lead to worst situations where in the foot amputation becomes compulsory.

Diabetics can prevent foot ulcers

1. Following two basic health care formulas – careful control of diabetes and foot care-, can easily control diabetic foot ulcers.

2. Keep blood sugar levels in check. This helps prevent peripheral neuropathy and also avoids it from worsening.
3. Diabetics should regularly check their feet, especially the areas between toes. They have to see whether the feet have any sores and cuts. If they find any problem, they should consult the doctor immediately for treatment. You can use a long-handled mirror to check your feet, to find out even the little problems.
4. Always keep your feet dry and clean, especially the areas between the toes, to avoid foot ulcers.
5. Before going for bath check the temperature of the water. Don't bath with hot water. It will worsen the foot ulcers.
6. People with peripheral neuropathy are not advised to cut their own nails.
7. Diabetics should consult a podiatrist, doctor specialized in foot care, for a regular checkup.
8. Diabetics should wear footwear that can fit properly to them. This helps avoid friction or pressure.
9. Diabetics suffering from peripheral neuropathy should stop walking barefoot. Before putting on the footwear make sure there are no foreign objects in them.
10. If the ulcers are in a very serious condition it's better to remove the dead tissue of the surface and apply synthetic wound dressings. This helps create a moist environment. Consult experts to get the advice on the dressings to be used. After studying the type of foot ulcer and at what stage it is the doctor will advice the best dressing.
11. If there us a significant infection that can lead to cellulites use antibiotics.

Prevent Infection

The goal of treating a diabetic foot ulcer is to prevent infection. Once an infection sets in, the wound can progress to the point of requiring amputation. To keep an ulcer free from infection, it is vital to keep blood glucose levels in control. High blood sugar can impair your immune response and make it more difficult to heal your ulcer. Clean the wound daily and keep it bandaged at all times. Do not go barefoot when you have an ulcer on your foot.

AvoidPressure

Relieve pressure on the ulcer by wearing special footwear or using crutches so you do not put pressure and irritation on the ulcer until it has healed. You may need to use a wheelchair so you can still get around without walking on your affected foot.

Medication

Regranex is a gel medication used to treat diabetic ulcers. The ulcer should be smeared with Regranex once daily using a cotton swab. After applying the medication, your ulcer should Ье covered with a clean saline dressing. In 12 hours remove the dressing, rinse the ulcer with saline or water and cover with a new saline dressing for 12 more hours. At that time, reapply the Regranex and repeat the procedure. Diabetic ulcers need air circulation to heal but according to the American Podiatric Medical Association, ulcers heal much faster if they are kept covered and moist as with a saline bandage. Saline is a salt water solution that can Ье purchased at a drugstore or medical supply store. Simply soak the bandage in the saline solution before applying it to your ulcer so it keeps your ulcer moist.

Surgery

If the ulcer becomes infected, surgery may be required. Your doctor may perform a skin graft. This involves moving healthy skin from another area of your body, from a donor or a bioengineered source, and transplanting it over your ulcer so it will heal faster. You may also need a debridement, which is the surgical removal of the dead tissue surrounding your ulcer. Your doctor may try bypass surgery, which improves the flow of blood through your leg and foot to help speed healing. If all other methods fail, a surgical amputation may be required to prevent the infection from spreading throughout your body.

Hyperbaric Oxygen Therapy

Hyperbaric therapy is often used to treat wounds that otherwise will not heal. To receive this type of treatment, you enter a small chamber that is pumped with oxygen while the atmospheric pressure is lowered inside. This increases the amount of oxygen in your blood, which helps the ulcer to heal.

Future trends in diabetic foot ulcers therapy

Though, diabetic foot ulcer develops secondary to Diabetes mellitus, it is usually considered as a separate entity in the medicinal realm from the treatment perspective. With frequent and common incidences of Diabetes mellitus all over the world, diabetic foot care study is becoming a priority especially in the field of podiatry. Though, treatment approaches such as topical formulations of growth factors, cellular and acellular matrix applications show very promising results, these formulations are expensive and are generally either dermal or epidermal analogs; mostly being dermal analogs. Use of human cadaver and other animal skin sometimes faces the problem of tissue rejection or failure of revascularization. Among all other causes of delayed wound healing, except the metabolic cause i.e. excess glycation cannot be treated with either topical formulation or matrix application at wound site. Therefore, pharmaceutical companies should focus their research on development of drugs that can inhibit AGE formation and their potential formulations for diabetic patients. Topical or systemic administration of EcNOS can be one more potential treatment that needs to be considered in diabetic ulcers as well. Thus, while treating diabetic ulcers, generalized treatment approach does not seem to be appropriate instead, selection of a particular treatment should be carried out on case-by-case evaluation considering severity of the wound and by using combination therapy if necessary. Chronic ulcerations are often colonized or contaminated with bacterial pathogens that can prevent ulcers from healing. Many such wounds become clinically infected and require treatment with antibiotics. However, early diagnosis of diabetic foot infections is a clinical challenge as typical signs and symptoms of infection, such as pain, redness, or elevated circulating inflammatory markers, can be absent in individuals with neuropathic or neuroischaemic ulcers. Failure to diagnose and treat such infections can lead rapidly to the infection spreading, with the possibility of tissue necrosis, gangrene, osteomyelitis, and ultimately the prospect of a lower leg amputation.Currently there are no antibiotics on the market specifically indicated for the prevention of diabetic foot infections. There is also reluctance by practitioners to use existing, systemically-acting antibiotics prophylactically because of concerns with systemic side effects and fear of propagating bacterial resistance with widespread use. Furthermore, diabetic ulcers are often associated with vascular disease and restricted peripheral blood flow, which may render systemically acting antibiotics less effective. By achieving very high localized concentrations of

antibiotic, Collatamp G is designed to overcome these concerns. Dressing a wound helps protect it and acts as a barrier to prevent contamination. Advances in tissue engineering, factors and antimicrobials have paved the way for more advanced treatments. Whatever the cause of the ulcer, any dead tissue of the surface should be debrided (removed) and synthetic wound dressings applied to ensure a moist environment.Honey dressings may also be useful. Expert advice should be obtained, as the best dressing will depend on the type of ulcer and stage of healing.

Stem cells help in healing diabetic foot ulcer

There is some good news for the diabetic patients in our country. There are about 4.5 crore diabetic patients our country where 40,000 lower extremity amputations occur per year.Treatment of chronic diabetic wounds is a continuing clinical problem and socioeconomic burden with diabetic foot ulcer alone costing some hundred million rupees a year. Studies done in Bristol University have found that human foetal stem cell can effectively be used to treat back leg ischaemic ulcers in a model of type 1 diabetes.Diabetic patients with ischaemic foot ulcers i.e. ulcers due to reduced blood supply to a tissue, have the worst prognosis of all chronic skin wound patients. The wounds also have higher amputation and mortality rate than the wounds of non-ischaemic ulcers.Topical gels with single growth factors have recently been used with some success in non-ischaemic ulcers but have failed in healing ischemic wounds. Ischaemic wounds are very resistant to other conventional treatment modalities.There is some good news for “ischaemic diabetic foot ulcers patients”. A new treatment involving stem cell therapy is round the corner. Podiatrist at the Diabetic Foot Care Clinic has treated some patients successfully with stem cells. They will soon start using stem cell therapy routinely to repair damaged tissues and for foot ulcers in diabetic patients at their clinic. At Fortis Hospital (Delhi & Noida) doctors are readying stem cell therapy for patients suffering from the disease as well.Stem cells are recognized for their ability to separate into various component cells of injured tissues, as well as to discharge growth factors that may encourage the formation of new blood vessels in the patient and thereby considerably speed up healing.This discovery provides a new perspective in the use of stem cells. It is known that wounds heal so well in foetuses that no scar can be visible at birth. It is therefore possible that, when foetal stem cells are transplanted onto diabetic ulcers, they reactivate a foetal program in the recipient to allow those adult ulcers to repair as efficiently as foetal wounds do.

Medical care diabetic foot ulcer

Write down the patient's symptoms and be prepared to talk about them on the phone with a doctor. Following is a list of common reasons to call a doctor if a person with diabetes has a diabetic foot or leg problem. For most of these problems, a doctor visit within about 72 hours is appropriate. Any significant trauma to the feet or legs, no matter how minor, needs medical attention. Even minor injuries can result in serious infections. Persistent mild-to-moderate pain in the feet or legs is a signal that something is wrong. Constant pain is never normal. Any new blister, wound, or ulcer less than 1 inch across can become a more serious problem. The patient will need to develop a plan with a doctor on how to treat these wounds. Any new areas of warmth, redness, or swelling on the feet or legs are frequently early signs of infection or inflammation. Addressing them early may prevent more serious problems. Pain, redness, or swelling around a toenail could mean the patient has an ingrown toenail - a leading cause of diabetic foot infections and amputations. Prompt and early treatment is essential. New or

constant numbness in the feet or legs can be a sign of diabetic nerve damage (neuropathy) or of impaired circulation in the legs. Both conditions put the patient at risk for serious problems such as infections and amputations. Difficulty walking can result from diabetic arthritis (Charcot's joints), often a sign of abnormal strain or pressure on the foot or of poorly fitting shoes. Early intervention is key to preventing more serious problems including falls as well as lower extremity skin breakdown and infections. Constant itching in the feet can be a sign of fungal infection or dry skin, both of which can lead to infection. Calluses or corns developing on the feet should be professionally removed. Home removal is not recommended. Fever, defined as a temperature over 98.6°F (37°C), in association with any other symptoms or even fever alone should prompt a call to a doctor's office. The degree of fever does not always correlate with the seriousness of infection. The patient could have no fever or a very low fever and still have a serious infection. People with diabetes need to be especially cautious of fever. Following are some common reasons to seek immediate medical attention for diabetic foot and leg problems. Severe pain in the feet or legs is often a sign of acute loss of circulation to the leg, serious infection, or may be due to severe nerve damage (neuropathy). Any cut to the feet or legs that bleeds significantly and goes all the way through the skin needs proper cleaning and repair to aid healing. Any significant puncture wounds to the feet (for example, stepping on a nail or being bitten by a dog or cat) carry a high risk of becoming infected. Wounds or ulcers that are more than about 1 inch across on the feet or legs are frequently associated with limb-threatening infections. Redness or red streaks spreading away from a wound or ulcer on the feet or legs are a sign of infection spreading through the tissues. Fever higher than 101.5°F (38.6°C) in association with redness, swelling, warmth, or any wound or ulcer on the legs may be a sign of a limb-threatening or life-threatening infection. If you are a person with diabetes and you simply have a fever more than 101.5°F (38.6°C), and no other symptoms, seek immediate care to determine the source of the fever and to initiate a plan of care. Because the degree of fever does not always correlate with the seriousness of the illness, people with diabetes should take even low-grade fevers [less than101.5°F (38.6°C)] very seriously and seek medical attention. The patient's doctor may or may not prescribe antibiotics, since fevers are often due to viral infections, which typically do not require antibiotics. Alteration in mental status (confusion) may be a sign of life-threatening infection that could lead to loss of a leg or foot, when associated with a leg wound or foot ulcer. Confusion may also be a sign of either very high or very low blood sugars, which are more common when infection is present.

Conclusion

Diabetic foot ulcers can, for many patients, seem to appear out of nowhere. Diabetics tend to lose sensation in the feet; therefore, they are more easily injured and they may not even notice that the injury has occurred. This can leave these ulcers untreated for a period of time and leave them susceptible to serious infection. Once a patient presents with a diabetic foot ulcer, a physician will need to determine if the ulcer is ischemic (caused by narrowing of the arteries), neuropathic (actual injury to the nerve) or a combination of both. Traditional treatment involves bandaging, using an anti-bacterial topical product and an orthotic to keep the pressure off the ulcer. This traditional method does not have an impressive success rate when used alone, but when combined with hyperbaric chamber treatment, the statistics show a significant rise. For instance, diabetics suffering with foot ulcers who undergo traditional treatment avoid amputation 61% of the time. However, with added hyperbaric oxygen therapy, the number rises to 89%.Hyperbaric

oxygen therapy involves little participation from the patient. The patient simply lies inside the hyperbaric chamber and breathes normally. While in the chamber, the patient is exposed to 100% oxygen and 2 to 3 times the normal atmospheric pressure. This pressure is equivalent to a diver reaching 50 feet underwater. This method of therapy exposes the infected tissues to high concentrations of oxygen. The atmospheric pressure increases the level of dissolved gases in the patient's blood by 2 to 3 times its normal amount. In other words, the oxygen dissolved in the blood increases from 0.32% to 6.8%.Base your treatment protocol on the etiology of the ulcer. Assuming that there is adequate perfusion to heal a plantar ulcer, one should have appropriate shoe modifications made to disperse weight away from the ulcerative area. Absorb any excess discharge and maintain a moist wound environment with appropriate product selection. Keep the wound edges dry. Make sure no sinus tracking occurs. Watch for infection. Debride necrotic debris and the hyperkeratosis rim as they are induces of for infection.

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