

A review on treatment and management diabetic foot ulcer

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ABSTRACT

Diabetes is a disorder of metabolism. Diabetic foot ulcer is one of the major complications of diabetes mellitus. Diabetes mellitus is a metabolic disorder which slows down the wound healing process. Many studies show a prolonged inflammatory phase in diabetic wounds, which causes a delay in the formation of granulation tissue and reduction in wound tensile strength. Diabetic ulcers form due to a combination of factors, such as increased body weight, numbness of the foot, poor circulation, irritation, and trauma. Ulcers often progress to infections of the surrounding tissue, osteomyelitis, and amputation.

KEY WORDS: Diabetes, Hyperglycemia, Insulin, Ulcer

INTRODUCTION

Diabetic foot ulcer is one of the major complications of diabetes mellitus. Diabetes mellitus is a metabolic disorder which slows down the wound healing process. Many studies show a prolonged inflammatory phase in diabetic wounds, which causes a delay in the formation of granulation tissue and reduction in wound tensile strength.^[1]

An ulcer is defined as a break in the skin surface that may involve the subcutaneous tissues or even deeper to the level of muscle or bone.^[2] Ulcers form due to a combination of factors, such as increased body weight, numbness of the foot, poor circulation, irritation, and trauma, as well as duration of diabetes.^[3] Ulcers often progress to infections of the surrounding tissue, osteomyelitis, and amputation.^[4,5]

Patients who have diabetes for many years can develop neuropathy. Neuropathy is a reduced or complete lack of ability to feel pain in the feet, caused because of nerve damage due to elevated blood glucose level for a long period of time. The nerve damage often can occur without pain, and one may not even be aware of the problem.^[6] This can be one of the causes leading

to foot ulcer. If the foot ulcer gets infected, it cannot be cured by medication; in such cases, amputation is the only choice. Amputation refers to surgical removal of the ulcer.

PATHOPHYSIOLOGY

Ulcer in diabetics can be because of three reasons: neuropathy, peripheral vascular diseases, and microangiopathy. Neuropathy can be of two types somatic and autonomic. In case of somatic, the limbs lose its sense of pain and proprioception, which leads to increased foot pressure. Increase in foot pressure for a prolonged period of time causes muscle weakness which ultimately leads to foot ulcer. In case of autonomic, the cause of foot ulcer will be because of impaired blood flow regulation.

Peripheral vascular diseases and microangiopathy cause foot ischemia. Ischemic foot refers to a lack of normal arterial blood flow from the heart to the feet.^[7] There is not enough blood reaching the foot to provide the oxygen and nutrient needs required for the cells to continue to function. In case of peripheral vascular diseases, the blood vessels are narrow and there is reduced blood supply to legs and feet. It also causes nerve damage which leads to loss of the feel of pain. In the absence of pain, the patient will not realize the wound or ulcer in the foot and will continue putting pressure on the affected area, this makes the affected area worse, and the presenting ulcer or infection will

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spread to the bone. Once the infection spreads to the bone, the damage cannot be reversed and it leaves us with one option which is amputation. The most common sites of amputations are toes, feet, and lower legs.

CLASSIFICATION OF FOOT ULCER

Foot ulcer in diabetic patients can be classified based on the depth of ulcer penetration, the presence of wound infection, and the presence of clinical signs of lower-extremity ischemia.^[8,9]

Stages

- Stage A: No infection or ischemia
- Stage B: Infection present
- Stage C: Ischemia present
- Stage D: Infection and ischemia present.

Grading

- Grade 0: Epithelialized wound
- Grade 1: Superficial wound
- Grade 2: Wound penetrates to tendon or capsule
- Grade 3: Wound penetrates to bone or joint.

MANAGEMENT AND TREATMENT

Healing is the primary goal to be achieved in the treatment of foot ulcer in diabetic patients. The faster the healing, the less chance for an infection. Management of foot ulcer also depends on the severity and grading of foot ulcer. Lesser the grade and stage, faster and easier the management. The risk of ulceration and limb amputation in people with diabetes can be improved by routine preventive podiatric care, appropriate shoes, and patient education.^[10]

The initiating injury may be from acute mechanical or thermal trauma or from repetitively or continuously applied mechanical stress.^[11]

Treatment of diabetic foot ulcer includes debridement, wound coverage, platelet-derived growth factors (PDGF), enzymatic debridement, miscellaneous topical agents, hydrotherapy, treatment of Charcot foot, vacuum-assisted closure (VAC), surgical care, revisional surgery, vascular reconstruction, hyperbaric oxygen treatment.

Debridement

Debridement is defined as the removal of damaged, dead, and/or infected tissues to improve healing process. Removal may be surgical, mechanical, chemical, and autolytic.^[12]

Wound Coverage

Optimal wound coverage requires wet-to-damp dressings, which support autolytic debridement, absorb exudate, and protect surrounding healthy skin.^[13] For

wounds that are neither very dry nor highly exudative, a polyvinyl film dressing which is semipermeable to oxygen and moisture and impermeable to bacteria can be used.^[14]

PDGF

PDGF when applied topically on the wound promoted the healing. Becaplermin gel (0.01%) is a recombinant PDGF which is produced through genetic engineering that is approved by the US Food and Drug Administration to promote healing of diabetic foot ulcers.^[15]

Enzymatic Debridement

Collagen comprises a significant fraction of the necrotic soft tissues in chronic wounds; the enzyme collagenase, derived from the fermentation of *Clostridium histolyticum*, helps to remove nonviable tissue from the surface of wounds.^[16] However, it is not a substitute for an initial surgical excision of a grossly necrotic wound.

Miscellaneous Topical Agents

Various other topical agents that have been used for wound management include sugar, antacids, and Vitamins A and D ointment.^[12,15]

Hydrotherapy

Intractable, infected, cavity wounds, sometimes, improve with hydrotherapy using saline pulse lavage under pressure.^[17]

Treatment of Charcot Foot

Charcot foot is a condition causing weakening of the bones in the foot that can occur in people who have significant nerve damage (neuropathy). Charcot foot is treated initially with immobilization using special shoes or braces but eventually may require podiatric surgery such as osteotomy and arthrodesis.^[18]

VAC

Clean but nonhealing deep cavity wounds may respond to repeated treatments by the application of negative pressure under an occlusive wound dressing VAC.^[19]

Surgical Management

Debridement of the dead and infected tissues from the ulceration and curettage of the underlying osteomyelitis bone are under the surgical management.^[20] All patients harboring diabetic foot ulcers should be evaluated by a qualified vascular surgeon or podiatric surgeon who will consider debridement, revisional surgery on bony architecture, vascular reconstruction, and options for soft-tissue coverage before any surgical procedures.^[11,20]

Revisional Surgery

Revisional surgery for bony architecture may be required to remove pressure points.^[21] Such intervention includes resection of metatarsal heads or ostectomy.

Hyperbaric Oxygen Treatment

Hyperbaric oxygen therapy is used rarely and is certainly not a substitute for revascularization.^[22] In the presence of an intractable wound and associated non-correctible ischemic arterial disease, hyperbaric oxygen therapy may be beneficial.^[23]

GLYCAEMIA CONTROL

The Diabetes Control and Complications Trial, performed by the Diabetes Control and Complications Trial Research Group, studied the effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus in the year 1993.^[24] In this, it was found that uncontrolled hyperglycemia is related to diabetic microvascular complications, and if it is under control, the complications of diabetes including neuropathy and nephropathy can be prevented.^[24]

MEASURES FOR PREVENTION OF DIABETIC ULCERS

The risk of ulceration and limb amputation in people with diabetes can be improved by routine preventive podiatric care, appropriate shoes, and patient education.^[20] Diabetic clinics should screen all patients for altered sensation and peripheral vascular disease.

Cigarette smoking should be stopped, and hypertension and hyperlipidemia should be controlled.^[5] Of diabetic foot ulcers, 85% are estimated to be preventable with appropriate preventive medicine.^[25,26]

CONCLUSION

Diabetic foot can be prevented by daily foot inspection, gentle soap and water cleansing, application of skin moisturiser, and inspection of the shoes to ensure good support and fit. Minor wounds require prompt medical evaluation and treatment. Prophylactic podiatric surgery to correct high-risk foot deformities may be indicated. Hot soaks, heating pads, and irritating topical agents should also be avoided.

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