

# A Review: Diabetic Foot Ulcer

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**Abstract-** *Diabetic foot ulcer (DFU) is the most costly and devastating complication of diabetes mellitus, which affect 15% of diabetic patients during their lifetime. Based on National Institute for Health and Clinical Excellence strategies, early effective management of DFU can reduce the severity of complications such as preventable amputations and possible mortality, and also can improve overall quality of life. Diabetic foot ulcer (DFU) is the most common complication of diabetes mellitus that usually fail to heal, and leading to lower limb amputation. A foot ulcer can be shallow or deep. When it starts, it looks like a red crater or dimple on the skin. If it becomes infected, it can develop drainage, pus, or a bad odor. People who use insulin are at a higher risk of developing a foot ulcer, as are patients with diabetes-related kidney, eye, and heart disease. Management of diabetic foot disease begins with a detailed history and thorough physical examination. This examination should focus on the manifestations of diabetic neuropathy and peripheral arterial disease, and, in particular, any evidence of diabetic foot ulcers or infection.*

**Keywords-** Diabetes mellitus, Wound management, Diabetic foot ulcer, Amputation, Foot care.

## I. INTRODUCTION

Diabetes mellitus (DM) is a serious systemic disease with an increasing incidence in the United States and worldwide. More than 30 million people in the United States are affected by DM, and much like a malignant disease, multisystem organ involvement is frequent. Lower extremity manifestations are frequently associated with substantial morbidity and mortality. Diabetic foot disease arises from chronic pathologic processes such as neuropathy, peripheral artery disease (PAD), biomechanical problems, and impaired wound healing. Although patients with diabetic foot disease have high rates of premature mortality, they have been shown to fear major amputation more than death.

**Pathophysiology:** The etiology of diabetic foot disease is multifactorial, and includes complications of diabetic neuropathy, vasculopathy, immunopathy, and poor glycemic control. Diabetic neuropathy results in sensory, motor, and

autonomic nerve dysfunction and is the most common cause of diabetic lower extremity ulcers. With proper screening, approximately 75% of diabetic patients undergoing foot and ankle surgery will be found to have neuropathy.

Because of an inability to determine injury or trauma, peripheral neuropathy is mostly associated with high rates of skin breakdown and neuropathic fractures. The inciting trauma could be caused simply by ill-fitting shoes or minor sprains and strains. The risk of developing a first DFU has been shown to be 7 times higher in those with moderate or severe sensory loss compared to patients with preservation of sensation. Without protective sensation, a neuropathic patient lacks the physical symptoms that would normally cue healthy individuals to examine or rest their feet, thereby increasing the extent of skin damage before presenting for treatment. Autonomic neuropathy also contributes to ulcer formation as it affects both physiologic secretions and the arteriovenous systems leading to dry, flaking, and fragile skin. This increases the risk for fissuring and skin breakdown, creating potential sites of infection. Motor neuropathy can lead to structural changes to the foot. These changes are in part due to muscular imbalance and weakness caused by intrinsic atrophy, frequently manifesting as claw toes, hammertoes, prominent metatarsals, and other deformities. These deformities change pressure patterns on the foot making certain areas more susceptible to trauma or ulceration. Peripheral arterial disease (PAD) is commonly seen in combination with neuropathy, in the diabetic population, and can contribute to foot complications. Approximately 50% of patients with diabetic foot disease have some degree of PAD. Compared to diabetic patients with Charcot neuropathy, patients with DFUs are significantly more likely to have PAD, critical limb ischemia, and more often require revascularization.

## II. EVALUATION

### Clinical Examination

Proper management of diabetic foot problems begins with a thorough evaluation of the patient. A detailed history should be obtained, including the duration of diabetes, insulin dependence, existing comorbidities, operative history, family

history, social history (tobacco or alcohol abuse, support network), and current medications. Symptoms of claudication and neuropathy are of particular importance and should be elicited in the history. Transcutaneous oxygen pressures (TcPO<sub>2</sub>) can provide additional information about wound healing potential and can identify changes in the microvascular circulation. Any evidence of ischemia should warrant referral to a specialist experienced in endovascular therapy and angiography. Depending on the location of the occlusion, this may include vascular surgeons, interventional radiologists, or interventional cardiologists. Revascularization can restore circulation at the macro vascular level; however, pathologic changes in the micro vascular system will persist and may negatively impact wound healing.

### Laboratory Testing

The addition of laboratory data is valuable to quantify the severity of the infection and response to treatment. These data should include a complete blood count, metabolic panel, erythrocyte sedimentation rate, and C-reactive protein. Albumin and prealbumin should be obtained to assess nutritional status. Glucose levels should be obtained, as loss of glycemic control is often one of the first signs of infection. Imaging modalities are of value to characterize the extent of soft tissue and bony involvement. Plain radiographs are useful in the initial workup of a diabetic foot infection. Particular attention should be paid to any radiographic abnormalities, such as cortical erosions, periosteal reactions, soft tissue gas, or radiopaque foreign bodies.

### Advanced Healing Modalities

Recent attention has been directed toward advanced healing modalities, such as hyperbaric oxygen (HBO) and negative-pressure wound therapy. There is considerable debate on the efficacy of HBO, with a recent prospective, double-blind, randomized controlled trial failing to show any reduction in amputation rate with HBO and wound care when compared to wound care alone. In comparison, negative-pressure wound therapy has been shown to improve wound healing when compared to advanced moist wound therapy. Current evidence does not support the use of antibiotic therapy in the management of non-infected ulcers.

#### Recurrence

Patient education plays a key role in preventing recurrence by increasing patient compliance through improvement in understanding. Despite these interventions, recurrence rates of ulcers remain high, with some studies reporting upwards of 40% recurrence. The high recurrence rate is likely due to the fact that the underlying pathology (the

peripheral neuropathy and PAD) are still present regardless of ulcer resolution. With chronic or recurrent ulcers, physicians should carefully monitor for infection and be aware of the risk factors for infection.

### III. CONCLUSION

Diabetes is a systemic disease with serious lower extremities manifestations including diabetic foot ulcers and diabetic foot infections that lead to substantial patient morbidity and mortality. The etiology of diabetic foot disease is multifactorial, and includes complications of diabetic neuropathy, vasculopathy, immunopathy, and poor glycemic control. Proper management of diabetic foot problems begins with a thorough clinical evaluation of the patient followed by early treatment with an emphasis on preventative strategies. The best preventative approach centers on, education, close follow-up, and clear communication between a multidisciplinary team composed of surgeons, hospitalists, endocrinologists, infectious disease specialists, and wound care experts.

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