Diabetic Foot Complications

Preface

Foot ulcers develop in approximately 15% of individuals with diabetes and foot disorders are a leading cause of hospitalization among this group.\(^4\) Eighty-five percent of lower limb amputations in persons with diabetes are preceded by foot ulcers, indicating that foot ulcer prevention and management are of paramount importance.\(^4\) The most important factors related to the development of foot ulcers are peripheral neuropathy, minor foot trauma and foot deformities. Diabetic foot ulcers are complex and multi-factorial in nature, often involving ischemic and neuropathic components, the latter of these two occurring within 10-15 years of diagnosis in 50% of diabetic patients.\(^5\)

Entirely ischemic ulcers are relatively uncommon, occurring in only about 10-15% of the diabetic population with foot ulcers. Atherosclerotic disease is 20 times more common in the lower limbs of patients with diabetes compared with age and sex matched controls.\(^6\) Trauma to the lower limb in diabetics with ischemic disease can often initiate a cascade of ulceration and amputation; the most common cause of initial injury is inappropriate footwear.\(^4\)

Neuropathy is a common component of ulceration and will be discussed as three categories; motor, autonomic and sensory.

Peripheral motor neuropathy is highlighted by a change in joint mobility and a loss of tone in intrinsic foot muscles. Changes to the musculature of the foot result in hammer toes, hallux valgus and callus production.\(^7\) A reduction in ankle and toe joint mobility related to glycosylation of collagen within the joint structure alters pressure on the plantar surface of the foot\(^5\) and increases the likelihood of tissue breakdown.

Peripheral autonomic neuropathy causes the formation of arteriovenous shunting. Shunt formation results in the inhibition of temperature regulation to the foot and is demonstrated by a warm foot with bounding pulses. These foot tissues have a reduced ability to sweat resulting in dry skin, skin cracks and fissures.\(^5\) Openings in the skin can be a portal for bacterial invasion and, if unnoticed because of sensory loss, can result in ulceration.

Peripheral sensory neuropathy is the most commonly recognized etiology of foot ulceration; approximately 80% of diabetic patients with ulceration have peripheral sensory neuropathy.\(^5\) This loss of protective sensation, as a result of large and small nerve fiber damage\(^7\) puts the individual with diabetes at risk of unnoticed injury, resulting in an increased likelihood of ulceration and possibly unrecognized infection. The identification of sensory changes in the diabetic lower limb is easily accomplished by the use of a 5.07 Semmes-Weinstein monofilament to the plantar foot surface in several locations \(^8\) (see Appendix 2 for sample diabetes foot screen form and instructions for screening process).
In summary, structural changes resulting from peripheral neuropathy alter the pressure to the walking surface of the foot. Tissues are less able to tolerate the increased plantar pressures as a result of decreased elasticity because of tissue glycosolation. Lack of protective sensation leads to a lack of awareness on the part of the individual and the person continues to ambulate. Repetitive high pressures to the sole of the foot as a result of walking, cause callus formation, and tissue breakdown at these pressure points can result in hemorrhage and ulceration. Foot complications in people with diabetes can be reduced by preventative measures like good glucose control, diabetes education and self-management, not smoking, sensation testing, appropriately fitted foot wear, routine foot examination and professional nail and callus care.