

Foot Care in Patients With Diabetes Mellitus

Foot ulcers and other foot problems are a major cause of morbidity, mortality, and disability in people with diabetes. In the presence of neuropathy and/or ischemia, the sequence of minor trauma leading to cutaneous ulceration and wound-healing failure is a frequent cause of lower-extremity amputations in diabetic patients (1). Once the amputation of one limb has occurred, the prognosis for the contralateral limb is poor (2).

Techniques to prevent amputation range from the simple, but often neglected, foot inspection to complicated vascular surgery. Appropriate management can prevent and heal diabetic foot ulcers, thereby greatly reducing the amputation rate (3–6). The guidelines herein outline the essentials of foot care for people with diabetes. Additional information is available in *Diabetic Foot Care* (7).

Patients are at high risk to develop foot ulcers or infection if they have any of the following conditions: neuropathy, vascular disease, structural deformities, abnormal gait, skin or nail deformities, or a history of previous ulcers or infections. All such patients should be seen by a physician at regular frequent intervals.

Patients are at low risk for foot lesions if they have none of the above abnormalities. They should receive instruction on basic preventive foot care and have routine foot inspections.

GENERAL GUIDELINES FOR FOOT EVALUATION

Patients' legs and feet must be examined, including between the toes and the posterior aspect of the heels.

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This examination should be performed by a qualified health-care professional at every regular visit. A comprehensive vascular, neurological, musculoskeletal, and skin and soft tissue evaluation should be done at least annually.

The vascular evaluation should include palpation of the pulses in the lower extremities and inspection of the feet and legs for any gross ischemic changes. If significant peripheral vascular disease is present, a vascular consultation should be considered.

The neurological exam should include a sensorimotor examination of the lower extremities. If sensorimotor deficiencies exist, footwear modification should be considered.

Musculoskeletal evaluation should include foot and ankle joint range of motion and inspection for bone abnormalities. If abnormal conditions exist, a qualified specialist should be consulted.

The patient should be observed for abnormal gait or stance (with and without shoes) and abnormal wear patterns of his/her shoes. The cause of any observed abnormalities should be ascertained and appropriate therapy provided or consultation obtained.

PATIENT EDUCATION

Patients with diabetes must be educated and understand proper foot care. Low-risk patients should be instructed about 1) foot hygiene, 2) proper footwear, 3) avoidance of foot trauma, 4) the need to stop smoking, and 5) actions to take if problems develop, which include when to see a health-care professional. In addition, high-risk patients and their family members should be taught to perform daily foot inspections. Education should continue until the patient can verbalize and demonstrate

proper foot-care practices. Neuropathic and vascular complications and their relationships to foot problems should be explained.

DIABETIC FOOT ULCERS

Prompt and proper care of diabetic foot ulcers is essential. The health-care professional should 1) establish the ulcer's etiology; 2) measure its size; 3) establish its depth and determine the involvement of deep structures; 4) examine it for purulent exudate, necrosis, sinus tracts, and odor; 5) assess the surrounding tissue for signs of edema, cellulitis, abscess, and fluctuation; 6) exclude systemic infection; and 7) perform a vascular evaluation.

Radiological examination. A radiological examination may be required to exclude subcutaneous gas, presence of a foreign body, osteomyelitis, and Charcot's foot. Plain radiographs may demonstrate periosteal resorption and osteolysis, which are consistent with but not diagnostic of osteomyelitis. To differentiate osteomyelitis from Charcot's foot, additional imaging studies (e.g., triple-phase bone scan, ^{111}In white blood cell imaging, magnetic resonance imaging) or a bone biopsy may be necessary.

Bacterial cultures and antibiotics. Bacterial infections of foot lesions are commonly polymicrobial. Thus, if infection is suspected, broad-spectrum antibiotic coverage should be initiated immediately and modified as necessary based on culture results. Culture by swab technique may be misleading. The recommended technique consists of sterile saline irrigation of necrotic tissue followed by curettage of the base of the ulceration.

Debridement. All abscessed infections should be incised and drained. Debridement must extend to viable noninfected tissue.

Wound care. The role of foot soaks (i.e., prolonged immersion of the foot in water) and topical agents in the treatment of diabetic foot ulcers is controversial. Although several topical agents (e.g., antiseptic solutions) have been proposed to speed the healing of diabetic foot ulcers, there are no adequately controlled studies that demonstrate their efficacy. Hence, a general recommendation on foot soaks and similar topical treatments cannot be given.

Metabolic control. Infection and/or inflammation may result with widely fluctuating blood glucose levels. Surgical and antibiotic treatment of abscesses or deep infection may help bring blood glucose levels under better control. Conversely, patients with severe hyperglycemia may have decreased ability to fight infection; therefore, good control of blood glucose should be a primary goal of the patient's total care. Poor nutritional status may hinder the healing process and must be corrected promptly.

Circulation. Patients with slow or inadequate healing who have decreased pulses and/or pressures by Dop-

pler examination may be candidates for vascular reconstruction. Vasodilator drugs have not been demonstrated to aid in healing of diabetic foot ulcers. Vasoconstrictor drugs should be avoided.

Mechanical stress. It is essential to minimize weight bearing on the ulcer. Modifications of weight bearing include bed rest and crutches, total-contact casts, shoe inserts, and special shoes. All patients on bed rest should have heel and ankle protection and daily inspection of both legs.

Posthealing treatment. Patients with healed foot ulcers are at risk for future ulceration. The education program for these patients should stress daily examination of the feet and prompt notification of a health-care provider if problems arise (see PATIENT EDUCATION). Patients whose work requires them to be on their feet for extended periods may require job modification. Prescribed footwear will benefit patients with a history of foot ulcers. Footwear options include walking or athletic shoes, soft insoles, extra-depth shoes with custom-molded inlays, and custom-molded therapeutic shoes. If unfamiliar with therapeutic footwear, the health-care provider should seek assistance from a qualified footwear specialist.

CHARCOT'S FOOT

The physician must be aware that an acutely swollen foot with negative radiographic changes in a patient with diabetes may represent the early stage of Charcot's foot. When present, this condition requires careful observation and appropriate rest, elevation, and immobilization. Distinguishing Charcot's foot from infection or monarticular arthritis may be difficult, and careful follow-up is required.

REFERENCES

1. Pecoraro RE, Reiber GE, Burgess EM: Pathways to diabetic limb amputation: basis for prevention. *Diabetes Care* 13:513-21, 1990
2. Ebskov B, Josephsen P: Incidence of reamputation and death after gangrene of the lower extremity. *Prosthet Orthotics Int* 4:77-80, 1980
3. Edmonds ME, Blundell MP, Morris HE, Thomas EM, Cotton LT, Watkins PJ: The diabetic foot: impact of a foot clinic. *Q J Med* 232:763-71, 1986
4. Davidson JK, Alogna M, Goldsmith M, Borden J: Assessment of program effectiveness at Grady Memorial Hospital—Atlanta. In *Educating Diabetic Patients*. Steiner G, Lawrence PA, Eds. New York, Springer-Verlag, 1981, p. 329-48
5. Runyan JW: The Memphis Chronic Disease Program. *JAMA* 231:264-67, 1975
6. Assal JP, Muhlhauser I, Pernat A, Gfeller R, Jorgens V, Berger M: Patient education as the basis for diabetes care in clinical practice. *Diabetologia* 28:602-13, 1985
7. *Diabetic Foot Care*. Alexandria, VA, Am. Diabetes Assoc., 1990