Establishing a Diabetic Lower Extremity Program (Part 1)

Physicians who provide ongoing patient education, prescribe appropriate shoes and practice an aggressive multidisciplined approach to wound care have reduced the lower extremity amputation rate in their patients by more than 50%.

By John Nesbitt, MD

Diabetic foot problems remain one of the major challenges associated with diabetic management. Of the estimated 1.7 to two million Canadians with diabetes, approximately 3,500 will require major lower extremity amputations this year.[1] And, the patient's suffering does not stop there since:

- Approximately 20% of patients requiring below-knee amputations will not heal their surgical wounds without further wound revision or an above-knee amputation.[2]
- This patient's five-year rate of contralateral amputation is 50%.[3]
- This patient's five-year survival rate after the first amputation is only 40%—the major cause of death being cardiovascular (i.e., strokes, heart attack or complications associated with the diabetic foot).[4-6]

Indeed, this is a grave situation. So how we can we stop this downward spiral of complications leading to further amputations and continued patient suffering? To start with, the rate of major amputations remains high, in part, because basic diabe-tic foot-care

education programs are not readily available in the primary-care physician's office.

The purpose of this article is to promote the establishment of a primary-care physicians' office-based "Diabetic Lower Extremity Preservation Program" (Table 1). Part 1 of this two-part article will provide a quick and easy method of recognizing both the systemic and local signs of the high-risk diabetic foot patient. Once you have identified the high-risk patient, Part 2 will provide some recommendations regarding patient education, skin and nail care requirements, accommodative footwear characteristics, exercise programs and job restrictions.

The author's goal is to prompt the establishment of a basic diabetic foot-care education program in each physician's office—a measure which can decrease the rate of lower extremity amputations by 50%—an objective which is surprisingly easy to obtain.[7]

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Table 1

AN OFFICE BASED DIABETIC LOWER EXTREMITY PRESERVATION PROGRAM—NURSE-INITIATED, PATIENT-DRIVEN AND PHYSICIAN-DIRECTED

This program is for the physician's office group, who recognize:

1) That 20% of all of their patients have a glucose intolerance problem.
2) Diabetic foot ulcers are common and are a major cause of morbidity and mortality.
3) That, because of time constraints, they cannot address all the potential problems a diabetic patient faces, but have a compliant nurse interested in a new clinical challenge.
4) An upgrade of their clinical skills regarding the recognition of diabetic lower extremity complaints and knowing when and where to refer patients who are having difficulties would make their lives easier and practices more fulfilling.
5) That there are potentially significant financial rewards for providing this service to their patients.

This program is designed to be initiated by your nurse, who can:

1) Perform a preliminary lower extremity and foot examination.
2) Check for the loss of protection sensation using a monofilament.
3) Make a quantitative risk assessment of the patient, and then provide the appropriate footwear and foot-care education.
4) Repeat and reinforce this information while examining the patient's legs/feet and footwear at subsequent office visits.
5) Provide skin and nail care for your diabetic patients as your office program expands.

The High-Risk Diabetic Foot Screening Examination

You do not need to spend a lot of office time or money on equipment to perform a comprehensive diabetic lower-extremity examination. The most important screening test is checking for the patient's loss of protective sensation in the stocking distribution, bilaterally. This is done by using a Semmes-Weinstein® 5.07 monofilament (cost approximately $60) or a hollowed out Bic® pen with a piece of light-test fishing tackle sticking out the end. The point is that touch discrimination is being tested, not the ability to differentiate between a sharp and dull touch.

Your nurse can assist the patient to undress from the waist down and perform this test. If normal sensation is present, then diabetic footwear education can be given; if a loss of protective sensation is found, then diabetic foot-care education can be given (Table 2). If this neurologic deficit is found, you should schedule a separate follow-up appointment to complete the lower extremity and risk assessment examination.

After you have finished the lower extremity examination, you can categorize the patient's degree of risk and make further rec-

Table 2
GENERAL PRINCIPLES OF FOOT-CARE EDUCATION

- Target the level of information in co-ordination with the specific needs of the patient. Those not at risk only require general advice about foot hygiene and footwear.
- Suggest these "dos" rather than "don'ts" in your teaching approach. This will convey foot-care in a positive light and may be more acceptable to the patient.

  DO—inspect the feet daily.

  DO—report any problems immediately (i.e., all skin lesions, including fissures, abrasions, calluses, hot or red spots and web space maceration).

  DO—buy shoes with extra-depth toe boxes and molded rocker soles.

  DO—inspect the inside of shoes for foreign objects everyday before putting them on.

  DO—visit a skilled skin and nail specialist on a regular basis.

  DO—cut your nails straight across and not rounded.

  DO—keep your feet away from heat (fires, radiators, hot water bottles) and check the bath water with a thermometer or your elbow before stepping into it.

  DO—wear something on your feet at all times to protect them and never walk barefoot.
- Repeat this advice at regular intervals and you or your nurse should check that it is being followed at each office visit.
- Disseminate advice to other family members and health-care professionals involved in the care of the patient.

ommendations regarding footwear, skin and nail care, and exercise and job restrictions (Part 2).

Now, we will walk through, in detail, a diabetic, peripheral vascular disease (PVD) patient's lower extremity examination. Particular attention will be paid to clues of impending problems, treatment and referral suggestions.

Clinical Evaluation

The initial evaluation of the diabetic foot patient is a clothes-off versus a shoes-off procedure. Deformities of the hips and knees must be taken into account, since they will increase the biomechanical loading or pressure on particular aspects of the foot and ankle.

Physical Illness: Is Depression the Cause?

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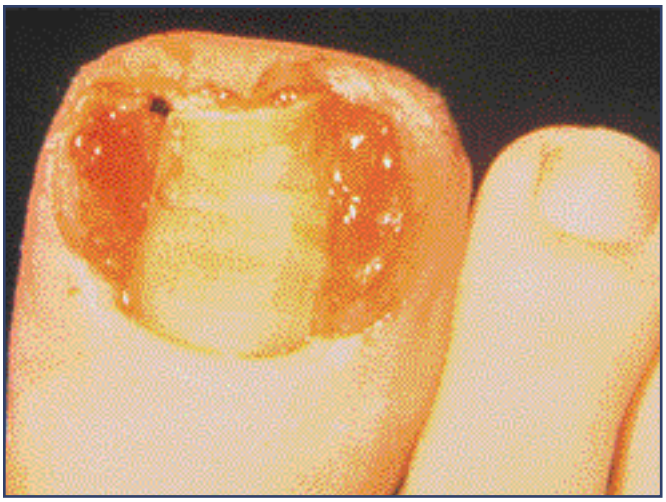


Figure 1. Ingrown nail: should be treated with prophylaxic surgery, since an infection at this site can spread proximally to form a dorsal foot abscess.

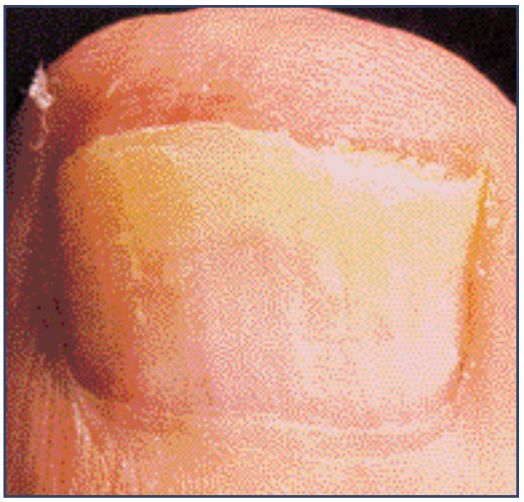


Figure 2. Onychomycotic nail: can lead to subungual ulcer formation and, therefore, should be treated.

During follow-up visits, your nurse will play a pivotal role in the running of this program, by assisting the patient with removal of his/her shoes and socks, performing a preliminary foot inspection and also reviewing important diabetic foot-care practical points.

Foot Evaluation

Skin and Nails. You should start by checking the complexion of the patient's skin on the anterior shin, the dorsal aspect of the foot, web spaces, metatarsal arch area, periphery of the heel pads and the nails. Specific points of interest include:

1. The skin over the anterior shin in the diabetic patient may show evidence of granuloma annulare, idiopathic hemorrhagic bullae, xanthochromia xanthoma or necrobiosis lipoidica diabeticorum lesions. Please familiarize yourself with these conditions, since, with minor trauma, these lesions can break down and require immediate attention.
2. The skin on the dorsal aspect of the foot should be smooth and non-thickened, containing hair follicles, particularly over the toes. The classic signs of severe PVD are the absence of pulses in a cold foot, with a loss of hair over the toes and shiny atrophic skin on the dorsum of the foot. Such patients are at extreme risk of lower extremity pathology, and must be examined once a month by a health-care professional.
3. Interstitial web spaces, particularly the fourth web space, may be macerated and white secondary to tinea pedis, moniliasis, psoriasis, soft-corn or mixed bacterial infection. Differentiation between these conditions may be difficult, necessitating a dermatologic or infectious disease consultation to ensure a web-space infection

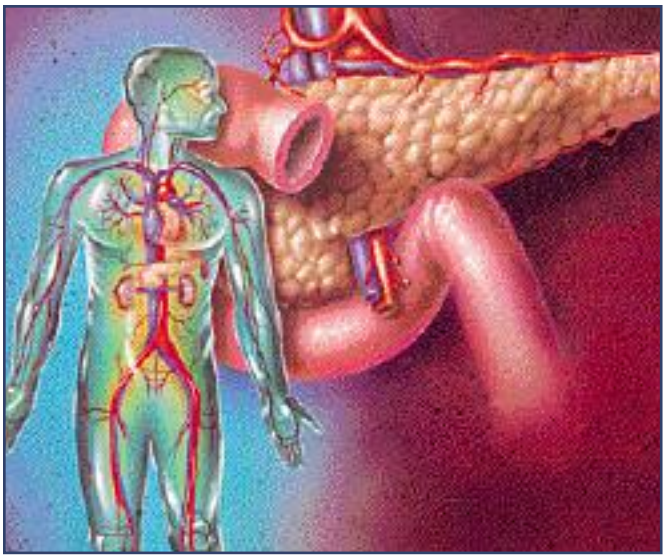
does not spread into the deep tissue (central plantar space) of the forefoot.

4. Hypertrophic (calluses/corns) lesions are formed secondary to pressure from poorly fitted shoes or adjacent digits. Prescribed footwear and routine professional skin and nail care is necessary for patients with calluses and corns, since, if left untreated, they will lead to subkeratotic ulcerations or frank plantar ulcers.
5. Atrophy of the plantar fat pads, plantar fissuring and loss of sebaceous gland function are all evidence of peripheral autonomic dysfunction. Prescription footwear is suggested for these patients.
6. Onchocryptosis (ingrown nail) should be attended to prophylactically before a paronychia develops (Figure 1). Definitive nail-bed resection versus repetitive partial wedge resections are recommended when peripheral blood flow is adequate.
7. Onychomycosis is very common in the diabetic patient associated with tinea pedis (Figure 2). Unfortunately, asymptomatic subungual infections can develop under these thickened gryphotic nails secondary to shoe pressure, resulting in distal tuft osteomyelitits. Therefore, prophylactic treatment for onychomycosis and routine professional skin and nail care are mandatory for these patients.
8. Diabetic foot ulcers are potentially limb-threatening and, at times, life-threatening lesions (Figure 3). The most important decision in diabetic wound care is determining whether the patient has a neuropathic or neuro-ischemic foot lesion, and treating it accordingly.

Figure 3. Foot ulcers are limb- and, sometimes, life-threatening lesions. They should be identified as either neuropathic or neuro-ischemic and treated accordingly.

The standard treatment regime for diabetic foot ulcers includes:

- Manage concomitant medical problems (i.e., blood-sugar control, hypothyroidism, anemia, etc.). Good diabetic control improves fibroblast activity, capillary blood flow and leucocyte function, thereby enhancing wound resolution.
- Re-vascularize of ischemic regions. Objective tests are essential, consisting of ankle brachial indexes with doppler-determined toe pressures or transcutaneous oxygen assessment.
- Pressure relief is the mainstay of treatment for neuropathic, but adequately profused, foot lesions. This can be accomplished by the use of a total contact cast or air-cast walking brace with total contact insert. Ulcerogenic bony prominences must be excised and the Achilles tendon lengthened in some cases to decrease abnormal biomechanical forefoot pressures.



Tight glycemic control is the only prevention and deterrent to the progression of neuropathy.

- Aggressively treat infections, since they are deceivingly subtle, polymicrobic, tend to spread quickly and often are associated with underlying osteomyelitis.
- Routine sharp debridement of the wound for the complete removal of callus, fibrin and necrotic tissue accelerates wound healing. By debriding the wound, you are decreasing the lesions' necrotic debris burden and turning a chronic wound into an acute wound by releasing intrinsic growth factors, thereby enhancing wound healing.

The Neurologic Examination

The neurologic exam should be performed in diabetic patients at least once each year, since it is peripheral neuropathy, or the loss of protective plantar sensation, that is the major cause of diabetic foot ulcers and amputation.[8-10]

The neurologic examination records motor strength, reflexes, light touch and vibration sensation determination. Peripheral neuropathy appears to be a permanent complication of inadequate glycemic control. The exact etiology of peripheral neuropathy is unknown, but it is suspected that the nerve conduction is altered by: (1) an accumulation of glucose, absorbital and fructose in a nerve, (2) a decrease in neuromal myoinositol, which is important for nerve conduction, or (3) ischemia due to narrowing of the vessels in the vasanervorum.[7]

Peripheral neuropathy develops slowly, initially consisting of paresthesia and night cramps and progressing to loss of the Achilles reflexes, then loss of vibration and protective sensation in a symmetrical stocking and glove-type pattern.

Specific diabetic neurologic findings. Loss of protective sensation evaluation. The use of a monofilament is recommended. Press its tip to the point of buckling against the patient's skin in several locations on the sole and dorsum of the foot. Patients should be asked if they do or do not feel the probe. Patients who cannot detect (10 g of linear strength) are at risk of ulceration and require special diabetic foot-care education and follow-up.[11] This monofilament test is effective and less time-consuming than vibration and thermal sensation evaluation in the identification of the high-risk patient.[12]

Gait assessment. Ask the patient to walk barefoot down and back a short corridor to

check their gait. An ataxic pattern may develop, secondary to the peripheral neuropathy, producing an altered foot pressure distribution pattern and plantar calluses.

Motor strength. Unilateral entrapment syndromes also are common, including peroneal nerve palsy with the loss of mid-foot eversion and tarsal tunnel impingement, which may cause numbness and burning into the heel of the affected foot. In such cases, a neurologic consult is necessary because, if nerve conduction studies show a mechanical entrapment of either the peroneal or posterior tibial nerve branches, then a surgical nerve release is required.

Specific intervention. Patient indifference. Diabetes has been called "a disease of denial." Psychologists suggest that, in some patients, the degree of denial equals that of the alcoholic. Unfortunately, this denial is only compounded when the diabetic patient loses his/her plantar protective sensation. This makes it very difficult for a caregiver to impress upon them the critical nature of their predicament and have them comply with therapeutic recommendations. Therefore, concise diabetic foot-care education must be repeated by the nurse and physician to the patient at each clinic visit.

Alternative conditions. It is important to remember that there are other conditions in the diabetic that may cause peripheral neuropathy, including malignancies, pernicious anemia, spinal stenosis, alcoholism, herniated discs, pesticides, heavy metal exposure and vasculitis. Therefore, when a patient presents with peripheral neuropathy, screening tests for these clinical entities should be done.

Tight glycemic control is the only prevention and deterrent to the progression of neuropathy, as shown in the Diabetic Control and Complications Trial.[13] Various medications have been tested to see if they would rejuvenate diabetic peripheral nerve function, but, to date, the results have been disappointing.

Neurogenic pain. Diabetic patients can complain of pain, paresthesia, numbness and nocturnal dysesthesia with sleep disturbances. Fortunately, excruciating pain only is present in a small percentage of neuropathic diabetics. It is important to treat those patients whose pain is having a negative impact on their ability to perform their daily activities or on their sleep patterns.

Medications which have been effective in the treatment of neurogenic pain include amitriptyline, 25 mg twice daily, followed by 10 mg to 75 mg administered every hour of sleep, as well as carbamazepine or mexiletine HCL. Amitriptyline also can be used as a co-analgesic. Desipramine may be a better choice as a co-analgesic, since it has less anticholingeric and less cardiotoxic effect, especially in the elderly.

If these medications fail, paroxetine HCL at high doses (up to 50 mg per day) may be useful. For lancinating neuropathic pain, gabapentin may be helpful in dosages between 300 mg/day to 1,200 mg/day. Remember, that no single medication is effective in all patients; a trial of several drugs over a period of months may be necessary.

Referral. If you are presented with atypical neurologic findings, referral to a neurologist is strongly indicated.

The Vascular Examination

The second major challenge with the diabetic foot is the early detection, evaluation and management of PVD. Because PVD develops earlier and is more severe in diabetics, a vascular examination should be done at least once a year. Patients with evidence of PVD should be re-examined at least every four months.

There are several factors that make the diabetic clinical vascular evaluation difficult, including:

- The absence of a typical history of intermittent claudication or rest pain, due to ischemia in the neuropathic patient. The patient may complain of leg weakness, fatigue or heaviness, as opposed to specific pain.
- The distribution and severity of diabetic versus nondiabetic vascular disease (i.e., its earlier onset and its multi-segmental and more distal (i.e., below the knee) involvement.

The cardiovascular examination begins proximally with the femoral vessels and progresses down to the dorsalis pedis and posterior tibial vessels, making note of the limbs pulse status and its warmth and color along the way to the feet.

Specific diabetic vascular findings. The absence of pulses and a cool foot is highly suggestive of PVD. The loss of hair on the dorsum of the foot with shiny atrophic skin, secondary to ischemia, is a classic sign of severe PVD.

Beware of the sore toe. An excellent clue of severe underlying PVD is pain, which usually occurs in the distal foot or toe with elevation often at night, due to loss of the gravitational effect on the arterial flow.

Edema of the lower leg and foot. Peripheral edema, secondary to cardiac dysfunction, is a common precipitating factor in the appearance of gangrenous lesions. Peripheral blood flow is reduced by two factors in this instance: (1) decreased limb profusion from cardiac failure; and (2) the preexisting fixed atherosclerotic lesions.

This situation is now compounded by the fact that the patient tries to force his swollen and insensate feet in his walking shoes, so he can partake in his daily walking routine. This leads to skin breakdown along the margins of the foot or toes at sites of continuous pressure from poorly fitted shoes. If there is severe underlying PVD, these wounds can become gangrenous quite quickly.

Suggested interventions include:

- If there are signs and symptoms of ischemia present, a vascular laboratory can be of assistance in quantitating the degree of PVD. Unfortunately, ankle brachial pressure index testing in the diabetic frequently underestimates the extent and severity of arterial insufficiency. Only transcutaneous oxygen measurements and angiography are accurate in predicting wound healing and determining whether a bypass procedure is possible in the diabetic. Unfortunately, transcutaneous oxygen measurements often are not available and, in diabetic patients, particularly those with marked renal insufficiency, angiography can be contraindicated.
- Indications for vascular surgical consultation include: (a) a history of ischemia (i.e., rest pain, beware of the sore toe); (b)

ankle brachial index of less or equal to 0.6.; and (c) presence of a diabetic leg or foot ulcer refractory to optimal wound care and off-loading techniques.

- Vascular surgery. The decision to perform vascular surgery depends on the severity of the vascular impairment, risk associated with the surgery and the potential of rehabilitation. Advanced age does not preclude surgery, since revascularization can be as safe as a major amputation, as well as less costly.[14,15]

  Aggressive arterial reconstruction, including bypass grafts to foot vessels, also allows effective debridement of soft tissue and resection of osteolytic bone without amputation.

Conclusion

The purpose of this article is to explain the positive impact a diabetic foot-care eductaion program would have when offered in the primary-care physicians' office setting. If patients at high risk of developing foot pathology are identified early using these screening techniques, and appropriate preventative measures initiated, 50% of diabetic amputations will be prevented.

The second part of this article, to be published in August, will complete the lower extremity examination, looking at the musculoskeletal system and give a brief overview of the potential range of diabetic foot infections. Recommendations regarding patient eduaction, skin and nail care requirements, footwear, exercise programs and job restrictions also will be made. *Dx*

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Establishing A Diabetic Lower Extremity Program (Part 2)

Physicians who provide ongoing patient education, prescribe appropriate shoes and practice an aggressive multidisciplined approach to wound care, have reduced the lower extremity amputation rate in their diabetic patients by more than 50%.

By John Nesbitt, MD

This second article on diabetic lower extremity care will provide a quick and easy method of recognizing both the systemic and local signs of the high-risk diabetic foot patient. Recommendations regarding patient education, skin and nail care requirements also will be outlined, as well as advice about accommodative footwear characteristics, exercise programs and job restrictions.

The Musculoskeletal Examination

Foot deformities are very common in the diabetic with peripheral neuropathy. The reason for this is twofold:

1. Peripheral neuropathy leads to the development of "cocked-up toe" deformities.
2. An abnormality in diabetic collagen leads to restriction in joint movement, particularly of the subtalar joint, which results in a decrease in the shock-absorbing capacity of the foot during walking.

These two factors result in high plantar foot pressures and, in the neuropathic foot, are major contributing factors to the development of foot ulcers.

The musculoskeletal examination starts with a description of the foot type, followed by an assessment of the mobility of the individual joints, starting with the first toe. The objective of the exami-

nation is to identify areas of restricted joint movement and high plantar pressure points. The most consistent evidence of an area of high pressure or friction is callus formation.

Specific Diabetic Musculoskeletal Abnormalities

It is very important to identify areas of high plantar pressure, since these are the areas where tissue breakdown will occur. Physical findings indicating areas of high plantar pressure include the following:

- The first toe, limited hallux dorsiflexion (less than 30°), secondary to osteoarthritis, involving the first metatarsophalangeal (MTP) joint can lead to a refractory first toe plantar ulcer. A bunion deformity can lead to ulceration of the skin over the medial eminence.
- "Cocked-up toes" due to motor nerve dysfunction (i.e., weakness of the intrinsic muscles of the foot, cocking up of the toes occur) (Figure 1). This deformity is frequently associated with thinning or shifting of the metatarsal fat pad, particularly under the first metatarsal head. The skin at the tops and tips of the toes and under the first metatarsal head are, therefore, vulnerable to hyperkeratotic lesion (callus) formation and pressure-induced necrosis of the underlying tissue. Ulceration, infection and, subsequently, osteomyelitis and gangrene can develop at these sites.
- Achilles shortening, secondary to diabetic soft-tissue glycosylation, leads to abnormally high forefoot biomechanical pressures. This increased forefoot biomechanical forces, in conjunction with fixed forefoot bony deformities (i.e., bunions, hallux limitus and cocked-up toes), can lead to forefoot plantar or digit ulceration.
- Mid-foot pathology. The classic diabetic foot deformity is the Charcot foot. The Charcot joint or neuropathic ostearthropathy is a progressive degeneration of joint bones that can occur in any disease with a severe neuropathy (see Part 1—Neurological Examination, The Canadian Journal of Diagnosis, July 2000). While performing the screening exam, the mid-foot is palpated, with the examiner looking for early signs of inflammation (especially swelling or increased warmth, which could herald a Charcot change). The changes in bone alignment resulting from this process produce a rocker-bottom foot and pressure-induced mid-foot ulcers.
- Gait. Now ask your patient to walk barefoot the length of a short corridor to see if the areas you suspected were points of high plantar pressure are receiving more

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physical load during this dynamic test. With practice you'll get very good at this test.

Interventions

The interventions associated with musculoskeletal abnormalities are as follows:

1. Routine skilled callus care is essential to decrease the rate of pre-ulcerative lesion formation, particularly under the first metatarsal head and at the tops and tips of the cocked-up toes. The presence of a hemorrhage into a callus is an ominous sign and 58% of such lesions, when debrided, reveal an underlying full-thickness lesion.[1,2]
2. The ideal treatment for the fixed forefoot deformities is prophylactic surgery to straighten the toes or bunions while the patient's circulation is still adequate. This approach, however, has yet to be shown to be superior to the conservative approach in controlled studies.[3]
3. When prophylactic surgery for fixed forefoot deformities cannot be performed, patients should be prescribed extra-depth soft leather Oxford-type walking shoes with a custom orthotic, designed to disperse the points of high plantar pressure equally along the sole of the shoe. The addition of a forefoot or mid-foot rocker to these shoes also can be helpful in offload pressure points.
4. The Charcot foot (Figure 2). Patients with an acute Charcot foot often present with a red, warm foot with pounding pulses, and frequently give a history of minor injury to the foot or ankle a few days before. Despite the foot's horrific appearance, the patient may only report minor discomfort. Conversely, the patient may be surprised how painful their previously insensate foot is. Because an acute Charcot foot clinically mimics cellulitis, an infective process must first be ruled out.

Figure 1. Cocked-up toes; deformities increase the number of pressure points on the toes where calluses or ulcers can form.

The most consistent evidence of an area of high pressure or friction is callus formation.

Bottom line: a neuropathic patient presenting with a painful, swollen foot a few days after a minor injury with the absense of a portal of entry for infection and the absence of other signs or laboratory findings of infection is highly suggestive of an acute Charcot foot.

The Charcot foot in either its acute inflammatory or chronic bony deformity stage requires follow-up by a skilled foot-care spe-

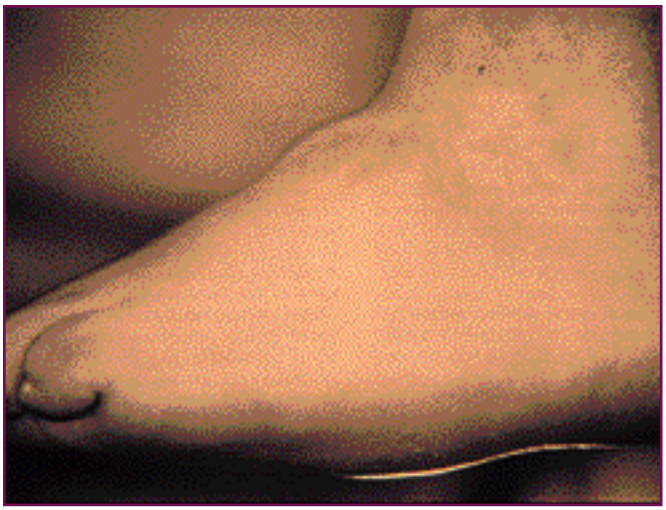


Figure 2. Charcot Foot; a progressive degeneration of joint bones that can lead to a rocker-bottom foot deformity.

cialist or orthopedic surgeon. It must be emphasized that, in the acute Charcot foot, there often are no x-ray abnormalities indicating an ongoing destructive process. But, if the patient is allowed to continue to walk on that foot, within weeks the tarsometatarsal joints can collapse, and the foot will start to take a rocker-bottom configuration.

Diabetic Infections

The aggressive treatment of diabetic infections is required, since they are deceivingly subtle, polymicrobic (two to six isolates can be found per ulcer, depending on culture technique), tend to spread quickly and often are associated with underlying osteomyelitis. The presence of an infection is suggested by local inflammation, purulent drainage, sinus tract formation and crepitus. The severity of cellulitis can range from a mild, localized infection to a limb or life-threatening, necrotizing process with fasciitis. Unfortunately, the physician cannot depend on white cell count or a temperature elevation as a measure of the severity of the underlying infection. In fact, fever, chills and leucocytosis are absent in two-thirds of patients with limb-threatening infections, which may include deep abscesses, extensive soft-tissue infections or a metastatic infection to a remote site.[4]

The diabetic patient is susceptible to severe infections since hyperglycemia impairs neutrophil function in vitro and may dampen the host's response to infection. Glycosylation of the structural proteins (keratin and collagen) results in stiffer connective tissue and, in conjunction with autonomic dysfunction, produces a board-like brittle plantar surface where skin fissures can easily form a portal for bacterial entry.

Specific diabetic lesions that can lead to significant infections include:

1. Burns, blisters and abrasions tend to be acute lesions brought on by specific precipitating events (i.e., not testing bathwater with a thermometer, poorly fitting walking shoes or overly aggressive callus bathroom surgery). Treatment consists of correction of the underlying behavior and proper wound care.
2. Calluses or corns are chronic lesions, which can harbor a "sub-lesion" hematoma that, when debrided, reveals a full-thickness ulcer 58% of the time.[1,2]
3. Onychomycosis. Thick onychomycotic nails can lead to subungual ulcer formation, secondary to chronic pressure from shallow toe-box shoes on the nail matrix.
4. Chronic plantar ulceration. This classi-

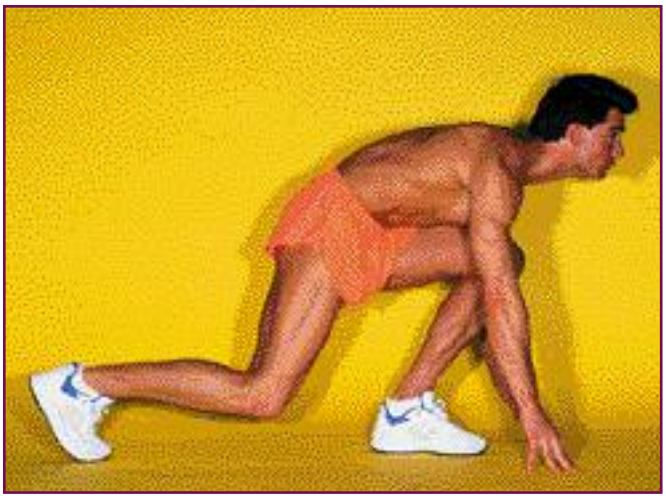
Table 1

RISK CRITERIA AND RECOMMENDATIONS FOR TREATMENT

Risk Care	Problem List	Follow-up	Footwear	Education	Skin and NailCare	Exercise and Job Restrictions
0 (Low)	• Diabetes • Normal sensation • +/- minor foot deformity	Yearly	Professionally fitted and accomodative	Footwear education	2-3 months	No restrictions. Encourage a regular exercise program
1 (Moderate)	• Diabetes • Loss of protective sensation • No deformity	6 month	Professionally fitted and accomodative, with total contact insole depending onlevel of activity	Patient education	6-8 weeks	No restrictions as long as footwear and skin and nail care recommendations are followed
2 (High)	• Diabetes • Loss of protective sensation • Foot deformity with callus formation	2-4 month	Professionally fitted and accomodative, with custom-molded foot orthosis	Patient education	6-8 weeks	Emphasis on nonweight bearing activities, such as swimming, biking, short walks (20 min, 2-3 times per day), weights and rowing
3 (High)	• Diabetes • Loss of protective sensation • Foot deformity • History of ulceration and peripheral vascular disease	1-2 month	+/- custom footwear to accomodate the foot deformity	Patient education	6 weeks	Gait retraining to take shorter steps. Jobs requiring standing or walking. These patients will need vocational counselling to assist with a career change

cally occurs over the first metatarsal head. Once an infection is established, deep extension into the central plantar space is uncommon, but contiguous spread to the metatarsal head frequently leads to osteomyelitis.

5. Plantar infection with dorsal foot inflammation. One must admit patients with what appears to be a minor plantar infection, with erythema and edema on the dorsal aspect of the foot. Even though the patient is not septic, there is a high probability that the infection on the plantar surface has penetrated deep into the tissue and has spread to the dorsum of the foot.
6. Infected toe pads and web spaces. Purulent discharge from a toe or web space with swelling of the sole of the foot may be evident, but, since pain and tenderness is frequently absent, the extent and severity of the infection is frequently underestimated and undertreat-



Proper footwear is the cornerstone of any ulcer prevention program.

ed. Infections in these areas, if left untreated, can rapidly spread to the central plantar space.

7. Dorsal foot lesions, such as a parenchyma, infected toe, blister or callus. Infections at these sites can spread proximally, and cause dorsal foot abscesses. This process can extend above the ankle with associated lymphangitis and inguinal adenopathy. Again, the severity of this problem often is underestimated and neglected due to the absence of pain, an obvious ulcer or portal of bacterial entry.

Interventions

As outlined above, because of the subtle clinical presentation of potentially limb-threatening infective processes, and the fact that laboratory tests may paint a benign picture in these situations, a physician must keep a high degree of clinical suspicion that he is only seeing the "tip of the iceberg" when presented with a diabetic infection or inflamed open lesion.

Indications for admission for intravenous antibiotic therapy and surgical debridement include sepsis, leukocytosis, peripheral vascular disease, suspected abscess formation, uncontrolled diabetes and inadequate home support. One should always err on the side of caution and monitor all diabetics with infections closely.

Footwear Evaluation

Because of the obvious link between poorly fitting footwear and foot ulceration, the importance of proper footwear is the cornerstone of any ulcer prevention program. All footwear must be fitted by a professional since, inevitably, when a patient who is insensate with neuropathy tries on a pair of shoes themselves and feels that the shoes fit well, the shoes are undoubtedly too tight.

Specific Diabetic Shoe Tips

1. It is important that you form a liaison with a local professional shoe fitter who stocks a variety of extra-depth accommodative shoes, and an orthotics manufacturer who is familiar with diabetic foot problems.
2. Patients with neuropathy, but a reasonably normal foot construction, must be fitted in commercial shoes with a firm cushioned sole and a soft, breathable

leather upper. Custom orthotics are recommended for patients with neuropathy, but are essential for patients with neuropathy and peripheral vascular disease or a past history of a foot ulcer.

3. Patients with mild structural abnormalities of the foot, such as hammertoes or bunions, need special commercial "extra-depth" shoes to ensure that the toe box is high and wide enough to accommodate these deformities. Soft total-contact orthotics are of benefit in this situation to decrease high plantar pressure points.
4. In the presence of full claw-toe deformities, severe bunions, Charcot joints or partial amputations, most patients will require custom-molded shoes with soft, accommodative custom orthotics.
5. Each time the patient returns to your office, their shoes should be checked inside and out, while reminding the patient to shake out their shoes and examine the inside of the shoes for tacks, toys, etc. each time they put them on. In this way, you are instilling the importance of footwear in the patient and their caregivers.

Patient Education With Follow-up and Exercise Recommendations

The effectiveness of diabetic foot-care education programs in reducing amputations has been well documented.[5,6] Because some diabetics are indifferent to their disease, the basic points of routine foot care must be repeated at each office visit, in a positive and enthusiastic manner.

Some practical hints on starting a diabetic foot-care education program:

1. Schedule special visits to convey this information in an unhurried, concise manner.
2. Advertise in your waiting room that you are offering this special service to heighten community awareness.
3. Emphasize that the basis of this program is the daily diabetic foot inspection. If the patient's vision is impaired, invite family members or friends into the examining room for these sessions, since their participation in this project is now critical.
4. Encourage your office nurse to play a pivotal role in the daily running of such a pro-

Encourage your office nurse to play a pivotal role in the daily running of your patients' foot-care education program

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gram, by assisting the patient in removing shoes and socks, performing the preliminary leg and foot exams, checking the shoes and orthotics, helping you assign the category of risk for each patient and planning their follow-up visit schedule.

5. Once the patient's initial degree of risk has been established, recommendations can be made regarding follow-up visits, footwear and orthotics, skin- and nail-care requirements, and exercise and job restrictions (Table 1).
6. Remember neuropathy is not reversible, and the patient's disease process will continue, requiring ongoing and updated risk assessment.

Bottom line: Foot-care education must be precise, positive and repeated regularly to have a maximum effect on the behavior of your patients.

Conclusion

The cornerstones of this preventative program are the patients' daily foot inspections, looking for pre-ulcerative lesions and the early detection of the loss of plantar protective sensation by the physician. Once a patient loses his/her plantar protective sensation, there is a moderate to high risk of developing foot pathology. The patient must be given foot-care education, prescibed accommodative shoes with custom inserts, and have arrangements made for them to receive professional skin and nail care.

Physicians who attempt to assess the risk of lower extremity pathology in each of their diabetic patients, as well as provide ongoing patient education, prescribe appropriate shoes and practice an aggressive multi-disciplined approach to wound care, have reduced the lower extremity amputation rate in their patients by at least 50%.[7]

As your confidence and expertise in this field develops, there will be no restrictions to the scope of the helpful services you and your staff can provide to your diabetic patients. *Dx*

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