CLINICAL MANAGEMENT extra

Validated 60-Second General Foot Screen: A Pilot Trial and Guide to Diagnoses and Treatment

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GENERAL PURPOSE:

To provide information on a 60-second General Foot Screen to assist in the prevention and/or identification and management of common foot problems.

TARGET AUDIENCE:

This continuing education activity is intended for physicians, physician assistants, nurse practitioners, and nurses with an interest in skin and wound care.

LEARNING OBJECTIVES/OUTCOMES:

After participating in this educational activity, the participant should be better able to:

1. Use the 60-second General Foot Screen to assist healthcare professionals in the recognition of common foot problems.

2. Identify risk factors, causes, and treatment of selected foot problems.

ABSTRACT

Foot health is important to overall patient health. Early diagnosis and treatment of diabetes, neuropathy, fungal foot infections, foot deformity, and vascular disease/lower leg edema can improve patient quality of life. One way to achieve this is effective screening. To this end, researchers piloted a validated 10-item screening tool to assess foot health on 120 patients; 74.17% had at least one positive abnormality, demonstrating the critical importance of these early findings. Only 25.83% of individuals had completely low-risk feet. This easy-to-use tool can assist healthcare professionals in the recognition and treatment of common foot problems. The article also outlines the early signs of disease by screening item and provides a guide to treatment to enable effective prevention and quality care.

KEYWORDS: diabetes, foot screen, fungal infection, neuropathy, preventive care, vascular disease

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INTRODUCTION

Foot health is a key component of overall health and well-being. The foot is a complex structure with 26 bones, 133 joints, 107 ligaments, and 19 muscles. The average lifetime wear and tear on a foot are equivalent to an estimated 100,000 miles.[1] Unhealthy feet can have a negative impact on walking, curtail physical activity, and decrease quality of life. Unhealthy feet can also be a source of pain as well as contribute to body image problems.[2–4] An ability to walk and participate in activities of daily living depends on foot health. More than 75% of older adults (individuals 65 years or older) will complain of foot pain associated with arthritic changes that may be seen with radiographic examination.[5,6] Moreover, 90% of older adults will have some type of foot problem including corns/calluses, bunions, hammer toes, or fungal infection.[6]

Both health providers and patients often overlook foot health, delaying early diagnosis and treatment of common foot problems.[7,8] This is true in both primary care and in specialized clinics.[7] Many healthcare providers find foot history and examination challenging and complicated to perform. This problem is exacerbated when patients afflicted by foot diseases do not inform their healthcare professionals.[9]

Foot abnormalities can be detected by a screening examination or by reviewing the common problems including fungal infection. Recently, a simple foot screen by Miller et al[9] called the "3-minute diabetic foot exam" was developed to help physicians and other healthcare professionals screen for lower extremity complications in patients with a suspected or confirmed diagnosis of diabetes. This exam is efficient, comprehensive, and requires no equipment.

However, there is a clear need for healthcare providers to implement routine foot screening protocols for the general population or those participating in specialized activities such as sports or athletic programs. Routine screening for patients with abnormal or high-risk feet can facilitate timely referral and appropriate healthcare resource utilization. Common foot abnormalities can be divided into four categories: skin changes, nail problems, bony abnormalities, and abnormal findings related to the vascular system.[10]

This article introduces an easy and quick, validated General Foot Screen with an enabler for interprofessional and primary care practice (Figure 1).

METHODS

Development of the General Foot Screen

Persaud et al[10] developed this validated tool (previously published as the Healthy Foot Screen) to facilitate timely treatment of common foot problems and assessed it for interrater reliability and validity. This process involved 18 patients from a community dermatology clinic. Each individual was assessed independently by 11 interprofessional healthcare providers using the tool. The interrater reliability was calculated using Cronbach α with a minimum acceptable reliability value of 0.60. Subsequently, the assessors completed a short questionnaire to provide feedback on the screen (strengths, weaknesses, and areas of potential improvement).

Parameters that passed the threshold for acceptable reliability in both feet included diabetes, smoking, neuropathy, palpable foot pulse, abnormal fourth to fifth toe web space, previous ulcer/amputation, pitting edema, bony abnormality, and dry bottom of foot. Items on the screen that were removed because of low reliability included subsets of toenail infection (distal streaks, discoloration, subungual debris), subsets of abnormal toe webs (wet, other web spaces involved), and secondary skin lesions (other spots/lesions, and red areas/blisters/pustules). After identifying the items with low reliability and assessing the feedback and recommendations, a consensus among the authors and assessors was reached to develop a revised version of the screen. The final published version only contained valid and reliable items, for a total of 10 items with 18 responses: items 1 and 2 have one response, and items 3 through 10 have two responses (one for each foot).

Pilot Study to Test Application to Practice

Researchers conducted a prospective cohort pilot study using this new screening tool. This study received ethics approval (#Pro00022415) from Institutional Review Board Services (Aurora, Ontario). Participants recruited were adult patients (18 years or older) attending a community dermatology clinic. Patients were excluded from the study if they had a known foot abnormality (eg, current foot ulcer, foot amputations) or if they were younger than 18 years. Convenience sampling was used, and verbal consent to participate was obtained by one of two assessors. Each patient was examined by one assessor for demographics (age and gender) and items of the screening tool (Figure 1). Data from

Figure 1.

GENERAL FOOT SCREEN

Name: _____

DOB (dd/mm/yy): ____/____/____ **Gender: M ☐ F ☐**

ID#: _____ **Phone #:** _____

Completed by: _____**Date of Exam (dd/mm/yy):** ____/____/____

Check both feet and circle responses where applicable

HISTORY	**1. Is the patient known to have diabetes mellitus type 1 or type 2?** *(If yes, **ALSO** perform simplified 60 second screen)*	Yes		No	
	2. Is the patient currently a smoker? *(If yes, counsel on smoking cessation)*	Yes		No	
	3. Does the patient have neuropathy? Ask about burning, stinging, shooting or stabbing in either foot *(Any person with neuropathy-perform simplified 60 second screen)*	**RIGHT** Yes	No	**LEFT** Yes	No
	4. Has the patient had a previous foot ulcer (U) or amputation (A) on either foot? (*If yes, perform simplified 60 second screen)*	Yes U | A	No	Yes U | A	No
INFECTION	**5. Are there signs of toenail fungal infection/inflammatory changes e.g. trauma, psoriasis?** *(If yes, should be treated)*	**RIGHT** Yes	No	**LEFT** Yes	No
	6. Are toe webs abnormal, especially 4/5th toe web? *(If yes, should be treated)*	Yes	No	Yes	No
	7. Is the bottom of the foot dry? (*If yes, should be diagnosed and treated)*	Yes	No	Yes	No
STRUCTURAL CHANGES ***List specific changes in the comments section below***	**8. Is there a significant bony abnormality or associated change?** *(Any significant bony change should trigger a foot specialist referral)*	**RIGHT** Yes	No	**LEFT** Yes	No
CIRCULATION	**9. Can you feel a foot pulse?** (*Absent dorsalis pedis & posterior tibial pulse = vascular laboratory assessment/ referral)*	Yes	No	Yes	No
	10. Any pitting edema of the feet/ ankle? *If yes, should be diagnosed and treated*	Yes	No	Yes	No

Refer to enabler for more information. Local referral patterns may vary depending on available resources

Other Comments/Abnormalities

_____
_____
_____
_____
_____

Recommendations/Treatment

_____
_____
_____
_____
_____

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the screening process were exported from paper to Microsoft Excel by a trained researcher, and results were then reviewed by the study authors.

A total of 120 patients (53 male and 67 female; mean age, 61.07 years) were analyzed. The parameters on the screen present in patients are outlined in Table 1. The screen was positive for one or more items in 74.17% of individuals, with only 25.83% having completely low-risk feet (no diabetes, no tobacco use, and no screened foot abnormalities). Several screened individuals had more than one positive item: 37.49% had two to four, 23.31% had five to eight, and 5.82% had nine or more positive items. Investigators also documented potential fungal foot infections: dry plantar skin was present in both feet in 36% of participants, potential onychomycosis was present in 31% (left foot) and 35% (right foot), and macerated toe webs in 11% (left) and 12% (right) of feet.

Table 1.
PARTICIPANTS WITH POSITIVE RESPONSES DURING THE FOOT SCREEN PILOT

Item	Right Foot, %	Left Foot, %
Dry plantar foot skin	36	36
Signs of toenail fungal infection	35	31
Structural changes: bony abnormalities	26	29
Foot neuropathy	15	14
Pitting edema of the lower limbs/feet	14	13
Abnormal toe web space	11	12
Absence of foot pulse	9	8
Previous ulcer or amputation	5	5
Diabetes mellitus (type I or II)	15	
Current smoker	10	

Diabetes was present in 15% of participants, 10% smoked, and 14% (left feet) and 15% (right feet) had potential neuropathy. Five percent had a previous foot ulcer or localized amputation. Bony abnormalities were noted in 29% (left feet) and 26% (right feet) of the study population. Nonpalpable pulses were recorded in 8% (left) and 9% (right), and pitting edema of the ankle in 13% (left) and 14% (right). These data are illustrated in Figure 2.

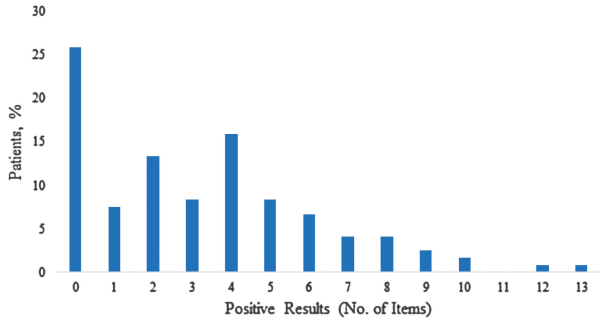
The results of this pilot study demonstrate that a significant majority (74%) of self-reported "healthy" adult patients had one or more extant foot pathologies. The following sections review the possible positive abnormal clinical findings and treatment for individual items.

SCREENING ITEMS AND RELATED TREATMENT CONSIDERATIONS

1. Does the patient have diabetes?

It is estimated that 9 million Canadians and 100 million Americans[11] are currently living with diabetes, undiagnosed diabetes, or prediabetes.[12] Patients with chronic and uncontrolled high blood glucose levels are at higher risk of developing microvascular complications including neuropathy, nephropathy, retinopathy, and macrovascular complications (coronary artery disease, peripheral arterial disease, and stroke).[13]

Figure 2.
POSITIVE RESULTS BY NUMBER OF PATIENTS (N = 120)



Persons with diabetes have 85% of the nontraumatic lower limb amputations in the developed world. The etiology of foot ulcers involves neuropathy, peripheral artery disease, or a combination of both (neuroischemic foot).[14,15] Building on this information, the authors have developed[16] and validated[17] a simplified 60-second diabetic foot screen that should be administered for all persons with diabetes.

Diabetes necessitates a very complex and demanding treatment protocol that depends on patients to self-manage their blood glucose levels at acceptable levels.[18] If a patient is diagnosed with diabetes, clinicians should refer him/her to interprofessional diabetes education teams including physicians (endocrinologist or other specialists, family medicine), nurses (with diabetes expertise), foot specialists (podiatry, orthopedics, other), allied health practitioners (dietician, social worker, a psychologist), and rehabilitation specialists (physiotherapist, occupational therapist). These teams can carefully educate patients on how to manage their diabetes. Primary care providers should also take time to educate patients on the ABCDES of diabetic care:

- **A1** target of 7.0% or less with exceptions for hypoglycemia
- **BP** targets of less than 130/80 mm Hg
- **Cholesterol** targets of a low-density lipoprotein cholesterol less than 2.0 mmol/L
- **Drugs** for cardiovascular disease risk reduction
- **Exercise** and healthy eating
- **Smoking**

2. Is the patient currently a smoker?

Smoking has profound deleterious effects on wound healing and compromised blood flow to tissues. The toxic compounds in cigarette smoke (including nicotine, tar, and carbon monoxide) have been shown to inhibit wound healing through the actions of anoxia, vasoconstriction, and hypoxia.[19,20] Moreover, smoking contributes to the development of peripheral arterial disease and angina by dysregulating normal endothelial function and being an important factor in the process of atherosclerosis.[21] Jensen et al[22] calculated that every cigarette decreases the circulation in the leg or foot up to 30% for an hour.

Unfortunately, the average smoker may need 30 or more attempts to stop smoking.[23] The most successful strategies include a combination of behavioral modification techniques (counseling, support groups) and medications. Coexisting psychosocial issues including other substance dependencies, depression, or anxiety need to be addressed if smoking cessation is to be successful. Medications that may be useful include nicotine replacement patches or gum, varenicline, and bupropion.

3. Does the patient have neuropathy?

Detectable peripheral neuropathy is common in persons with diabetes, with approximately 30% to 50% of patients affected.[24] Patients with neuropathy (particularly the sensory component of peripheral neuropathy) may lose the protective sensation in their feet, causing the experience of neuropathic pain (burning, stinging, shooting, or stabbing sensations). Neuropathic pain is a debilitating complication of diabetes; patients report poorer quality of life, decreased sleep, and higher anxiety and depression scores compared with individuals without neuropathic pain.[25]

If there is no diagnosis of diabetes, providers should check hemoglobin A_{1c} levels. Other conditions associated with neuropathy include:[26]

- systemic disease: thyroid disease, advanced liver or kidney disease
- vitamin deficiencies: low levels of B_{12}, vitamin E, thiamine
- toxins: excessive alcohol consumption, chemotherapy drugs, immunosuppressive drugs, heavy metals
- trauma: bone fractures, nerve compression
- infection: Lyme disease, HIV, syphilis
- connective tissue disease: rheumatoid arthritis, systemic lupus erythematosus, scleroderma, dermatomyositis

Treatment should include the correction of the spontaneous nerve pain. For daytime relief, antiepileptic drugs including gabapentin or pregabalin are often useful first-line drugs. For night pain, low doses of tricyclic antidepressants can facilitate sleep and control pain. Nortriptyline or desipramine are second-generation agents with more antinoradrenaline levels than amitriptyline at equal dosage levels. Other antiepileptic drugs may also be useful and include carbamazepine or lamotrigine. Resistant cases may respond to serotonin norepinephrine reuptake inhibitors that include duloxetine and venlafaxine. Patients with vitamin deficiencies need appropriate replacement therapy, and treatment is often required for other neuropathy associations.

4. Has the patient had a previous foot ulcer or amputation on either foot?

History of a foot ulceration and/or amputation is associated with an increased risk of future ulceration. Prior foot ulcers are indicative of an underlying foot abnormality, and previous amputations can induce changes in gait and foot shape and thus impact the risk of subsequent ulcer formation.[27]

Not all persons with a previous foot ulcer or amputation have diabetes. More than one-third of individuals who have had any two of the following: previous foot ulcer, previous lower limb amputation, neuropathy, or peripheral vascular disease, are likely to develop a foot ulcer in the next year.[28] This means that they need careful follow-up on a regular basis with a foot care specialist.

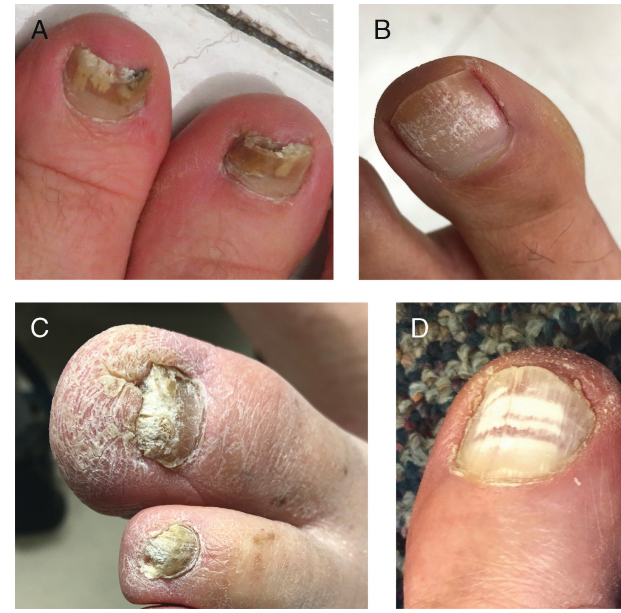
5. Are there signs of toenail fungal infection?

Approximately half of abnormal toenail findings are attributable to fungal infection.[29] Fungal infection of the nails has recently been added as a new criterion for a high-risk diabetic foot by the International Diabetic Federation.[30]

Tinea pedis is a cutaneous fungal infection that usually starts on the plantar skin and toe webs. The fungus then spreads to the nails (a state known as onychomycosis or tinea unguium) through the distal nail fold to the nail plate, creating a streak that is wider on the distal nail and narrow as it precedes proximally through the nail plate. This is distal subungual onychomycosis, the most common type of tinea pedis (Figure 3A). White superficial onychomycosis (Figure 3B) is less common than distal subungual onychomycosis and is characterized by the invasion of fungi into the superficial layers of the nail plate. It is identified by the presence of well-demarcated opaque "white islands" on the external nail plate that usually coalesce and spread as the disease progresses.[31] Treatment of white superficial onychomycosis consists of topical antifungal medication (Table 2).

Severe infections that are harder to treat involve the entire nail plate (whole-plate onychomycosis; Figure 3C) including the matrix, and the nail may be thickened with powdery subungual debris often accompanied with thickened scale along the nail fold.[38,39] These are prognostic signs with a lower treatment success. The lunula (white moon of the proximal nail) is the distal

Figure 3.
ONYCHOMYCOSIS



A, Distal subungual onychomycosis. The wide distal nail involvement tapers toward the matrix. B, White superficial onychomycosis. The surface colonies can be treated topically. C, Whole plate onychomycosis. Represents advanced nail disease and maybe indistinguishable or coexisting with extensive psoriatic nail dystrophy. D, Proximal subungual with white superficial onychomycosis. Primary involvement of the nail matrix (visible lunula) may be a sign of immunodeficiency. ©R. G. Sibbald. Images published with patient consent.

Table 2.
ONYCHOMYCOSIS THERAPIES[32–37,42]

Line	Therapy	General Comments[a]	RCT Results[b]
First line (oral)	Systemic terbinafine	• Adminstered at 250 mg/d for 12–16 wk • Contraindicated: chronic or active liver disease, pregnancy • Discontinue if gastrointestinal symptoms present and perform laboratory testing • Watch for rare fevers, loss of taste, or rare severe skin reactions • Rifampin increases metabolism • Cimetidine decreases metabolism	• 3 mo = 75.7% mycologic cure • 4 mo = 80.8% mycologic cure • Test complete blood count and platelets, liver function prior to starting treatment and every 4–6 wk • Takes 8 mo to 2 y for abnormal nail to grow out; should not have proximal spread • Can perform follow-up microscopy and fungal culture to follow progress
Second line (oral)	Systemic itraconazole	• Administered at 400 mg/d for 1 wk per mo for 3 to 4 mo • Contraindicated: congestive heart failure, pregnant or lactating women • 7% of individuals get headaches, rash, gastrointestinal upset • Absorption is best with a high-fat meal and/or an acidic beverage • Monitoring liver function only recommended with continuous rather than pulse therapy	• 3 mo = 38.3% • 4 mo = 49.1% • Drug interactions to avoid: quinidine, pimozide; ventricular tachyarrhythmia • Statins; muscle lysis • Histamine H_2 receptor antagonists, proton pump inhibitors decrease absorption
Oral (not FDA approved)	Other systemic agents	• Fluconazole and posaconazole are not currently approved by the FDA for toenail infections	• Not currently recommended for routine clinical use
Topical nail lacquers	10% efinaconazole	• Daily application for 48 wk • Canadian consensus: use efinaconazole for mild onychomycosis (<20% involvement from the distal nail or ≤3 nails)	• Two pooled RCTs of 1,655 subjects • 54.4% mycologic cure versus 16.9% on vehicle • Currently being studied in nails with 20%–60% involvement with oral medication
	5% tavaborole	• Daily application for 48 wk • Used for mild to moderate onychomycosis with no mycetoma or lunula (matrix) involvement	• 2 pooled RCTs of 1,194 subjects • 33.5% mycological cure versus 9.7% on vehicle
Topical therapy	Topical ciclopirox olamine	• The nail lacquers amorolfine 5% and ciclopirox olamine 8% are applied once per week and daily, respectively	• Two RCTs of 223 patients (study 1) and 237 patients (study 2) on ciclopirox olamine • Study 1: 29% mycologic cure versus 11% on vehicle • Study 2: 36% mycologic cure vs 9% on vehicle
Third line (not FDA approved)	Photodynamic therapy (PDT)	• Has been reported effective in *Trichophyton rubrum* onychomycosis. • Specific laser devices include the Nd:YAG and diode lasers • Study did not include fluconazole without PDT	• 24-wk RCT: group A received fluconazole oral placebo + 2% methylene blue aqueous solution irradiated with light emission diode device with 18 J/cm^2; group B received 300 mg oral fluconazole/wk plus placebo PDT • PDT was shown to be safe, effective, and well tolerated

Abbreviation: RCT, randomized controlled trial.
[a]The dosages of all of these medications are for toenail, not fingernail, fungal infection.
[b]RCTs show data for mycologic cure rate (ie, negative results that are shown on microscopy and negative results on fungal culture from samples taken of the target toenail). Clinical cure rates (100% toenail clearing) are not present because they can take up to 2 years or longer to achieve, which is longer than most studies.

end of the nail matrix that extends proximally under the skin surface ending halfway to the distal interphalangeal joint.[40] Primary involvement of the lunula (proximal subungual onychomycosis; Figure 3D) is most likely because of immune deficiency including HIV hyponychial infection.[41]

Onychomycosis diagnosis requires laboratory confirmation for systemic therapy. A variety of topical and oral antifungal medications are available for the treatment of onychomycosis.[42] Hygiene measures[43] are also important for preventing onychomycoses and recurrence. Nail infections are often acquired from health clubs, bathroom floors, around swimming pools, and from pedicures. Protective footwear on wet common area surfaces, avoiding foot soaks (especially for persons with diabetes), and ensuring hygienic conditions in foot spas also prevent fungal foot infections. Footwear and socks should breathe; tightly woven nonbreathable socks should be avoided because they may hold moisture. Instead, socks with moisture-wicking technology and breathable hybrid combination materials are encouraged. Aluminum chloride hexahydrate preparations from 6.25% to 20% at night can often inhibit sweating and prevent moist feet during the day for individuals prone to hyperhidrosis.[44] Treating tinea pedis before onychomycosis develops, smoking cessation, and control of chronic disease will also help prevent fungal foot infections.

6. Are the toe webs abnormal?

Fungal infections usually spread from the plantar surface of the skin to the toe webs and the toenails. Web involvement usually starts with dry scale that can become macerated with sweat from warm shoes or boots.[45,46] The macerated skin is a prime target for secondary bacterial growth including Gram-positive or Gram-negative organisms.[47,48] The Gram-positive organisms can invade the adjacent skin and cause bacterial lymphangitis and cellulitis of the lower leg. The fourth/fifth toe web space is the tightest and least ventilated interdigital web space, typically rendering it the first involved web space; this is followed by spread proximally to the other web spaces. Topical antiseptics in a water or lotion base are often useful to decrease microbial organisms in the web spaces. Povidone-iodine or chlorhexidine have a broad spectrum of action covering bacteria, yeast, and dermatophytes.

7. Is the bottom of the foot dry?

Dry skin on the plantar aspect of the foot can be seen with neuropathy or fungal infections. Neuropathy is associated with sensory (identified with monofilament test), autonomic (dryness is usually limited to the plantar skin), and/or motor components (loss of reflexes).[49] Autonomic neuropathy can cause dry skin on the plantar aspect of the skin, but this needs to be distinguished from fungal infections. Fungal involvement of the plantar skin also may manifest as dry feet, but the infection often involves the sides of the feet in a "moccasin" distribution (a fine red line at the distal end of the involvement).[50] There may be coexisting fourth/fifth toe web involvement as well as onychomycosis. Less commonly, three other clinical variants can be present: a hyperkeratotic thick change on the plantar aspect of the foot, an inflammatory presentation with small papulovesicules or pustules clustered around the plantar surface, and an even less common tiny erosive or ulcerative variant caused by a bacterial infection called erythrasma.[51]

Accurate diagnosis of tinea pedis is essential for proper treatment (Table 3), because tinea pedis can mimic other dermatologic conditions. To diagnose the presence of dermatophytes, lesion scrapings are performed with either the use of a blade (no. 15) or banana-shaped knife, and blister/pustule tops can be ruptured to remove culture samples. The sample is then analyzed with direct microscopy and fungal culture.[29]

8. Is there a significant bony abnormality or associated change?

A foot deformity is a disorder of the foot that can be congenital or acquired; they involve structural abnormalities or muscular imbalances that affect the function of the foot. The deformities are classified according to clinical appearance. The most common structural deformities of the foot are hammer toe, claw toe, mallet toe, hallux valgus, and flat foot. Bony/structural deformities are important to identify as a risk factor for foot ulceration.[53] Any significant bony change should trigger a foot specialist referral.

The most recognizable congenital foot deformity is clubfoot. It is characterized by dorsiflexion/plantar flexion of the ankle, inversion of the foot, and adduction of the forefoot. Manipulative treatment of congenital foot deformities, which requires manual repositioning and serial casting, should be initiated immediately after birth. The outcome depends primarily on whether the deformity responds well to manual repositioning with casting and splinting (flexible deformities). Resistant deformities often require surgical correction to reposition structures or relieve muscle contractures.

Hammer toe (Figure 4A) involves a flexion (downward) contracture of the middle toe joint or the proximal interphalangeal joint.[54] This deformity may be associated with a hereditary etiology or motor neuropathy.[55] Acquired causes include tight shoe boxes or pointed shoes that force the toe to bend forward. The compressive forces leading to hammer toe can be treated by ensuring shoes have enough space for toes to stretch.[54]

Claw toe (Figure 4B) is a deformity involving the most toe joints, resulting in hyperextension of the metatarsophalangeal joint and flexion at the proximal interphalangeal joint, and flexion of the distal interphalangeal joint.[54] It results from neurologic disorders (eg, rheumatoid arthritis, diabetes, cerebral palsy, stroke, etc) that cause muscle imbalances, leading to altered structural anatomy.[56] Treatment of claw toe includes conservative options such as roomy, well-fitting shoes, with a deep and wide

Table 3.
TINEA PEDIS THERAPIES[46,52]

Line	Therapy	Efficacy/Notes
First line (topical azole antifungal agents)	Clotrimazole Miconazole Luliconazole Econazole nitrate Sertaconazole nitrate Ketoconazole	• Fungistatic agents used to treat tinea pedis • Usually twice per day every 2 wk with mycologic cure in 70%–80% of individuals • Some studies used daily treatment • Have some anti-inflammatory action • Use solutions, gels in web spaces
First/second line (topical allylamine antifungal agents)	Terbinafine 1% cream Naftifine hydrochloride	• Fungicidal agents • Can be used once per day • Up to 90% mycologic cure after 1 wk • Terbinefine is prescription • Naftine is over the counter
Third line	Ciclopirox olamine (0.77%) cream, lotion	• Fungistatic cream or lotion used for tinea pedis • BID × 2 wk • Approximately 60% mycologic cure
Not FDA approved	Topicals: 40% urea cream Photodynamic therapy	• Urea cream hydrates the skin and acts as a keratolytic • Photodynamic therapy lacks randomized control trial evidence
Systemic therapy for topical failures	Terbinafine 250 mg Itraconazole 200 mg Fluconazole 100 mg	• Daily use • Usually 2 wk of therapy but may need to be repeated

Abbreviation: BID, twice a week.

toe box. If the deformity is fixed, surgical intervention is required to resect the bone and release the contraction of the tendons.

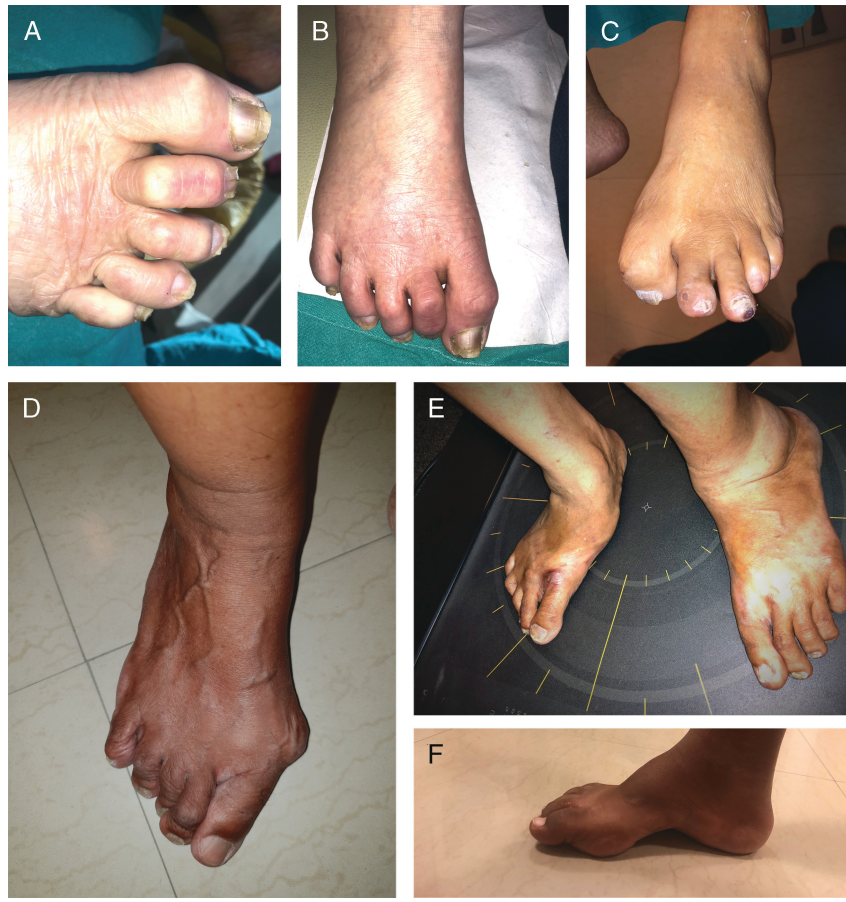
Mallet toe (Figure 4C) is a downward bending of the distal interphalangeal joint. This deformity is commonly associated with friction and pressure from faulty footwear or other toe injuries, bone and muscle imbalance, or arthritis. The condition may also be congenital.[54,57] It is most common in the second toe but can exist on other toes. Treatment may include a roomier shoe, cushioned padding, and avoiding high heels.[55] This condition can be improved by strengthening and stretching the toe muscles or, in some cases, with successful surgery.

Hallux valgus (Figure 4D; also called a bunion) is usually a hereditary condition with medial deviation of the first metatarsal and lateral deviations of the great toe.[58] This is commonly seen when patients have flexible joints and with the use of pointed shoes and high heels. People with flat feet are also susceptible to hallux valgus. They may occur in cultures in which shoes are not worn.[59] Nonsurgical treatment can include a hallux valgus splint, wearing shoes with a flat and roomy toe box, and customized orthotic or bunion pads. If nonsurgical approaches fail to provide relief, surgery is an option.

Flat foot (Figure 4E; also known as pes planus) is characterized by a completely fallen midfoot arch.[60] It may be best observed when the plantar foot comes in contact with ground during weight-bearing and standing. The condition may be congenital or acquired from a variety of conditions (stretched or torn tendons, broken or dislocated midfoot bones, rheumatoid arthritis, nerve degenerative problems, obesity, diabetes, pregnancy). Treatment often starts with arch supports, customized orthotics, or exercises; few individuals require surgery. Individuals with flat feet are more susceptible to plantar fasciitis or Achilles tendonitis. There may also be referred pain to the ankles, knees, hips, and back.

Pes cavus (Figure 4F) is a high arch that does not flatten with weight bearing; the foot stays locked.[61] Because the foot is not flexible or hollow on standing, it pounds the ground as the person walks. This may be a hereditary condition or may be secondary to neurologic conditions including cerebral palsy and Charcot-Marie-Tooth disease.[61] Many patients with a pes cavus can develop calluses and pain at the heel and ball of the foot. Treatment requires an accommodation to help absorb the increased pressures in these regions including different inserts to pad the foot (metatarsal pads and arch supports) that redistributes pressure to a larger portion of

Figure 4.
CONGENITAL FOOT DEFORMITIES



A, Hammer toe. The metatarsal-phalangeal joint is not involved, but there is flexion of the interphalangeal joint. B, Claw toe with elevation of the metatarsal phalangeal joint and flexion of both proximal and distal interphalangeal joints. C, Mallet toe. The distal interphalangeal joint at the end of the large toe buckles downward at a 90-degree angle. D, Hallux valgus. A bony prominence oriented medially on the first metatarsal phalangeal joint. E, Flat feet illustrated with a side and front view of a standing patient. F, Pes cavus or high-arch foot where the arch does not flatten with weight bearing, which increases pressure at the forefoot and heel. ©B. Kotru. Images published with patient consent.

the plantar aspect of the foot rather than control its movement. Persons with pes cavus are very susceptible to plantar fasciitis.

9. Can you feel a foot pulse?

A patient's vascular status (ie, blood circulation) can provide important insight into common foot health issues. The presence of peripheral pulses (ie, dorsalis pedis and/or posterior tibial pulse) represents a minimum systolic BP of 80 mm Hg and suggests adequate vascular supply to support wound healing.[62] A small percentage of individuals may have an absent or aberrant dorsalis pedis pulse, and the posterior tibial pulse should be palpated. Absent or diminished distal foot pulse(s) may be suggestive of peripheral vascular disease and should trigger a vascular laboratory assessment/referral.

Arterial disease can predispose individuals to "punched-out" arterial ulcers, critical limb ischemia, gangrene, and amputations.[63] Risk factors for peripheral vascular disease include smoking (the most important risk factor), diabetes mellitus, hyperlipidemia, hypertension, and coronary artery disease.

If the pulse cannot be felt, an ankle-brachial pressure index (ABPI) should be recorded with a portable 8 MHz Doppler to determine if there is any impairment to the lower extremity arterial blood flow. An ABPI value greater than 1.3 means the arteries are often calcified, and the test is usually falsely high and inaccurate. An alternative to the ABPI is the audible handheld Doppler waveform signal.[64] Monophasic audible waves or an ABPI of less than 0.6 identify poor circulation, and the need for the definitive noninvasive arterial vascular assessment is the segmental duplex

Doppler in the vascular laboratory. Adequate circulation is confirmed when multiphasic waves elicit an audible signal indicating an ABPI greater than 0.9.

Patients can pursue conservative avenues to improve peripheral circulation. This includes smoking cessation, a graduated exercise program, foot care, atherosclerotic risk factor reduction (ie, control of hyperlipidemia, hypertension, weight, diabetes), and avoidance of extreme temperatures. Patients with advanced arterial disease (dependent rubor, elevation producing pallor) or claudication with walking or at rest may be candidates for dilation or bypass procedures.

10. Any pitting edema of the foot/ankle?

Pitting edema of the lower limbs is a clinical sign of several disease states. If the pitting edema extends above the knee, systemic disease may be present, including anemia, congestive heart failure, or chronic liver/kidney disease.

Chronic venous insufficiency is the most common cause of lower leg pitting; this cause should be investigated further and managed. Venous disease can manifest with several progressive clinical signs.[65] The disease often begins with a dilated saphenous vein, followed by superficial varicosities and varicose veins leading to a leakage of serum fluid resulting in pitting edema. This edema often starts around the medial malleolus where the long saphenous vein is most superficial and has its greatest curvature. When the veins become porous to red blood cells, hemosiderin and melanin deposits result in superficial dark brown pigment most commonly around the lower gaiter area.[66] With chronic disease, fibrin also leaks out of the capillaries, causing lipodermatosclerosis such that the skin cannot be moved over the underlying structures. When the woody fibrosis spreads to the foot and toes, the changes are referred to as venolymphedema. Stemmer sign is the confirmatory test (when the skin on the dorsum of the second toe cannot be pinched between the thumb and index finger).[67]

Compression therapy with the use of elastic compression stockings is a well-known and established therapy used in the management of chronic venous insufficiency.[68] Stockings work by applying greater pressures at the ankle, with gradually decreasing pressures up the garment toward the knee. This pressure gradient allows venous blood to flow upward to the heart rather than pooling in the foot and superficial veins.[69] Many studies have shown that compression stockings reduce venous disease signs and symptoms, improve quality of life, and relieve lower limb aching, pain, and leg cramps.[70–72] Patients should be encouraged to wear compression stockings, unless there is a contraindicated condition or advanced arterial disease.

CONCLUSIONS

Foot health is a critical component of general well-being. The General Foot Screen is a validated, easy-to-use tool developed to identify common foot abnormalities for foot care clinicians, primary care providers, and any specialists regularly in contact with high-risk patients including those in endocrinology, dermatology, nephrology, and cardiology. The implementation of the General Foot Screen in everyday community clinical settings will improve the early identification of foot pathologies. The tool can improve patient outcomes with the basic diagnosis and treatment strategies outlined above and appropriate referral to other healthcare specialists (eg, chiropodists, podiatrists, endocrinologists, etc). Early detection of abnormal feet can improve general health!

PRACTICE PEARLS

- Foot health is an important component of general health and well-being that is commonly neglected by healthcare providers, leading to delayed diagnosis and treatment.
- Common foot problems include fungal infection of the skin, toenails, and toe webs; signs of neuropathy; bony abnormalities; and comprised vascular status.
- The validated 60-second General Foot Screen may promote the early identification and management of foot conditions.
- Treatment of common foot problems can improve quality of life.

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