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## The Agony of Da Feet: Reexamining the Foundation to Fitness

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## Case Study

# The Agony of Da Feet: Reexamining the Foundation to Fitness

By Amanda Lutter, DPM, AACFAS, and Christopher B. Stewart, DPM, FACFAS

### Educational Objectives

1. Explain the role of podiatry in helping older adults maintain wellbeing.
2. Provide an overview of common foot and ankle conditions that older adults should be concerned about.
3. Discuss newer services and techniques provided by podiatrists.
4. Review several cases in which podiatry supported patients' health through early interventions.

### Background

Foot pain affects approximately one in four older adults (Menz, 2016) and is a cause for decreased mobility and quality of life. Unfortunately, many view their foot pain as an inevitable consequence of aging rather than a treatable medical condition (Munro and Steele, 1998).

A podiatrist is a doctor of podiatric medicine (DPM) specializing in surgical and nonsurgical treatment of the foot and ankle in patients of all ages. Nowadays, podiatrists complete four years of podiatry school following undergraduate education and a minimum of three years of residency. Increasingly, podiatrists are opting to complete an additional year of fellowship. Podiatrists may choose to specialize in a variety of

fields including surgery, sports medicine, wound care, pediatrics, and diabetic care. Podiatrists are board certified by the American Board of Foot and Ankle Surgeons (ABFAS) as well as by the American Board of Podiatric Medicine (ABPM). Surgical podiatrists who are board certified by ABFAS may distinguish themselves with 'FACFAS' meaning that they are a fellow of the American College of Foot and Ankle Surgeons. Recent graduates who have passed all their written board exams, meaning that they are board qualified but are still collecting surgical cases, will designate themselves as an "associate," thus AACFAS.

Podiatrists can detect the early stages of disease that exhibit warning signs in the lower extremities, such as diabetes, arthritis, and cardiovascular disease. A comprehensive lower extremity exam includes evaluation of a patient's skin from toes to knee, blood flow in arteries and veins, nerve function, and multiple musculoskeletal conditions. Podiatric interventions are aimed at restoring function of the feet and ankle allowing for a healthier, more active lifestyle.

### Routine Foot Care

For patients with poor circulation, also known as Peripheral Arterial Disease (PAD), insurance companies will often cover patients to see podiatrists to have

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their nails and calluses trimmed. Although sometimes trivialized, fungal nails (*onychomycosis*) and ingrown toenails (*onychocryptosis*) can be exquisitely painful and disabling. Likewise, calluses may feel “like rocks embedded in my feet,” and for patients who have numbness in their feet (*neuropathy*), calluses can pose a risk for skin breakdown and ulceration. In the office, a podiatrist can safely trim calluses with a scalpel blade that causes fewer abrasions in the skin than may be caused by a pumice stone. Additional exfoliation may be achieved with creams containing acid such as urea or ammonium lactate which help to dissolve dead skin.

### Peripheral Arterial Disease

Peripheral Arterial Disease (PAD) results from narrowing of the arteries due to plaque deposition. In these patients, the arterial pulses in the feet, particularly the dorsalis pedis and posterior tibial arteries, are diminished or absent altogether. In severe cases, these patients may experience cramping in their legs while walking (*intermittent claudication*) or cramping while lying down (*rest pain*). The feet may feel cold. There may be wounds that do not heal. The color of the feet and legs may be reddish when below the level of the heart but pale when elevated (*dependent rubor*). In patients with any of the symptoms above, podiatrists may order an Ankle Brachial Index (ABI) that compares the blood pressure in the ankle to that in the arm. Abnormal levels prompt referral to a vascular surgeon who may perform various interventions as necessary.

### Footwear Evaluation

Studies have estimated more than one-half of older adults wear shoes that are too short or too narrow due to fashion influences, not measuring foot dimensions when choosing shoes, or limited supply options (McInnes, et. al., 2012). Many patients are aware shoes may be purchased as extra-wide, but fewer know that they may also select extra-depth shoes. Shoes with a deep toe box can decrease rubbing of hammertoes on the roof of the shoe. Moreover, the added room in the shoes makes space for *accommodative* inserts that are soft and offload pressure points on the sole of the foot. This is particularly helpful for patients with *plantar fat pad atrophy*. Other patients

who need more support in the joints of their feet may benefit from functional inserts that usually have a firm arch support that serves to support the alignment of the joints in the feet during the gait cycle. For example, with an arch support the foot tends to *pronate* (weight when walking placed more toward the inside of foot) less which mitigates the arch collapse. For patients who do not fit over-the-counter shoe inserts, custom orthotics may be prescribed by a podiatrist. These can be helpful when the shape of the foot is very flat or arches are unusually high or there are pressure points that can be offloaded specific to the patient.

### Fungal Infections

Many patients observe that their nails become thick, yellow, discolored, and crumbly in texture. Incidence of nail fungus (*onychomycosis*) increases with age, due in part to decreased circulation. There are fewer immune cells arriving to the toes to fight the fungal growth. Moreover, the relative dehydration of the nails causes them to curl and may produce ingrown toenails (*onychocryptosis*). The risk of neglecting fungal nails is that accumulation of a large fungal load can worsen Athlete’s foot (*tinea pedis*). Sometimes the webspaces between the toes can become excessively moist which encourages fungal infections that can then be complicated by bacterial superinfections. The authors have treated severe cases of cellulitis that arose from this combination of fungus and bacteria proliferating between the toes.

### Bunions and Hammertoes

Muscle imbalance can result in malalignment of one of more toes. While bunions are inheritable, the shoes we wear contribute to deformities in our forefeet. Narrow-toed shoes tend to push the great toe sideways into a bunion deformity. Toes may curl to fit inside the shoes. Digital contractures may also occur due to excessive pull of the long flexor muscles in the calf that are compensating for a weakened Achilles tendon muscle group. Patients with flat feet may develop calluses due to the long flexor muscles overfiring in effort to stabilize the foot after the arch collapses. Some patients with varying degrees of drop foot where the muscle group in the front of the leg is weak can have overfiring of the long extensor

muscles that can misalign the toes. Conservative management of bunions and hammertoes begins with padding, bunion splints, wearing wider shoes, and supporting the arch. Some patients with flexible digital contractures may benefit from the flexor tendon being lengthened which can be a simple in office procedure. Other patients benefit from having surgery in the operating room that involves either soft tissue realignment or a combination of soft tissue and bone work to reconstruct the forefoot.

### **Osteoarthritis**

Degenerative joint disease, or osteoarthritis (OA), is characterized by loss of cartilage in one or more joints. This may be caused by history of trauma or by wear-and-tear stress in the joints due to poor alignment. A flat foot lacks stability and may stretch the supportive ligaments in the foot and ankle, resulting in cartilage wearing down. On the other hand, a high arch is rigid, lacking in mobility, leading to increased jamming of the joints and subsequent increased risk of arthritis. Patients presenting with arthritis sometimes find relief from investing in more supportive shoes. Depending on the joint involved, immobilization can be helpful. A great toe joint that is arthritic may be immobilized for better modifications to orthotics, shoes with rigid soles that have a rocker bottom. An arthritic ankle may benefit from an ankle brace, either over-the-counter if that is comfortable, or custom Ankle Foot Orthosis (AFO). Additionally, anti-inflammatory treatments such as NSAIDs or steroids, either oral or injected directed into affected joint, can relieve pain. Physical therapy can strengthen muscles that improve stability in the foot and ankle helping to avoid injury. Surgery is indicated when conservative treatments fail to allow patients to enjoy activities of normal living. Arthritic joints may be fused or replaced, depending on the situation.

### **Stress Fractures**

Bone density decreases as we age, predisposing older patients to fractures. Stress fractures are tiny hairline breaks that can be caused by overtraining or overuse, improper biomechanics or surfaces, poor shoes, foot deformities, and osteoporosis. These small breaks can result in complete breaks in the bone if left untreated. Pain, swelling, redness, and sometimes bruising

can all be signs of a stress fracture. Conservative treatment involves immobilizing and offloading the foot with either a surgical shoe or pneumatic walking boot. Bone metabolism workup, including checking the thyroid and Vitamin D levels, is sometimes necessary. Patients are encouraged to consume a well-balanced diet rich in protein, calcium, Vitamin D, and Vitamin C. Sometimes stress fractures go on to require bone stimulators which are devices worn on the outside of the foot to encourage bone growth. Rarely, stress fractures require surgery, at which point bone substitute may be applied to the injury site.

### **Melanoma**

In the United States, melanoma accounts for 3-5% of all skin cancers and 65% of deaths related to skin cancer (Watson, et al., 2011). The proportion of melanoma arising on the foot was estimated to be 6.6% by one study of 1,542 lesions (Chevalier, et al., 2014). Increased risk is attributed to UVA and UVB ultraviolet light exposure, decreased skin pigmentation, increased mole count, lower socioeconomic level, and trauma.

Early misdiagnosis rates for melanoma in the foot are estimated between 25-36%, as compared to 18% body-wide. Reported misdiagnoses for melanoma of the foot have included ingrown nails, fungal nails, athlete's foot, eczema, warts, foot ulcers, bruising, blood blisters underneath the nail, foreign bodies, various soft tissue tumors, calluses, and other skin cancers such as basal cell carcinoma and squamous cell carcinoma. One study reported 13.5 months to be the average time to seek medical attention for 27 cases of melanoma on the foot (Bristow & Acland, 2008). Staging of melanoma is based on Breslow thickness, appearance of microscopic ulceration on surface of tumor, mitotic rate of tumor cells, and presence of nodal and distal metastasis (Balch, et al., 2009). Sentinel lymph node biopsy should be considered in lesions that are thick and ulcerated on microscopy, and when positive, the five-year survival rate drops from 84.3% to 37.5% (Ito, et al., 2015). Mainstay therapy in confirmed cases includes wide excision or amputation. As of 2016, eight gene-modifying drugs have received FDA approval for the treatment of advanced or metastatic melanoma (De Golian, et al., 2016).

Older adults face multiple obstacles to recognizing skin cancer. Poor vision, inflexibility, lack of awareness, depression, dementia, and abundance of benign age spots distracting from or camouflaging a malignant lesion may all delay diagnosis. In the diabetic population, assistive devices such as a mirror on the end of a stick may aid older adults to visualize the soles of their feet or the skin over their back. Ideally, they would undergo annual skin cancer screenings from head to toe by healthcare providers that would be augmented by exams at home.

In performing skin cancer screening, remember the “ABCDEs” of melanoma:

**A** = Asymmetry.

**B** = Border which may be irregular or blurred. “Hutchinson’s sign” refers to a streak of pigment extending from the top of the nail all the way to the nail bed and into the cuticle itself. This is seen oftentimes with subungual melanoma.

**C** = Color variation in which multiple shades of brown and black are present as well as pink, red, white, or blue.

**D** = Diameter greater than 6mm or the size of a pencil eraser. Melanoma, however, can present as small lesions.

**E** = Evolving that may present as changing shape, color, or size. Also, new sensations like itching or pain or new drainage are warnings.

Non-healing wounds are highly suspicious. For this reason, healthcare providers will often biopsy a wound that fails to heal as expected. The “ugly duckling sign” draws attention towards skin spots that look different than other skin spots on the body.

While detection of melanoma serves as a dramatic testament to regular lower extremity exams, individuals stand to benefit from earlier detection and treatment for a variety of other medical conditions. These include fungal infections of skin and nails which can cause breakdown in the skin and subsequent bacterial super infections possibly requiring hospitalization and sometimes amputations. Older adults dealing

with foot pain from hammertoe contractures and bun-ion deformities may benefit from shoe modification and toe padding. Nails and calluses may be debrided by medical providers allowing for more immediate pain relief. Plantar fat pad atrophy may improve with accommodative multi-density shoe inserts that offload pressure points. In summary, conservative as well as surgical treatment options may be offered for patients following lower extremity evaluations.

### Case Study #1

Mr. DS is a 94-year-old male who presented to an emergency department via ambulance complaining of generalized weakness and soreness as well as increased swelling in his left foot present for more than one year. He was living independently with help from neighbors and family. He had last seen his primary care physician four months earlier for complaint of sores on his left arm after falling in his daughter’s home.

Podiatry was consulted by the ED for evaluation of a protruding mass on the sole of the patient’s left foot. The mass measured 4.8 x 4.6 x 1.2cm and was slightly asymmetrical with an irregular border and multiple colors ranging from yellow to red to black (**Figure 1**).



Figure 1. In the ED the patient states, “I stepped on a nail awhile back.”

Moreover, the patient’s left foot was noted to be swollen all the way up to his knee on the left side only. The right leg was thin and dry. Radiographs obtained in the ED demonstrated a soft tissue density without bone abnormality (**Figure 2**). The differential diagnosis included pyogenic granuloma and nodular melanoma.



Figure 2. Radiopaque ovoid soft tissue density without osseous abnormality.

When questioned about mass on the sole of his foot, Mr. DS replied, “I stepped on a nail awhile back.” He was not physically able to visualize the soles of his feet and had not been using an assistive device. He did not recall when the last time a family member or health care provider had removed his shoes to examine his feet.

The patient was admitted to the hospital with sepsis, acute kidney injury, lactic acidosis, rhabdomyolysis, and chronic deep vein thrombosis (DVT) of bilateral lower extremities. The mass was excised at bedside with a #15 blade and silver nitrate cautery. Pathology diagnosed the biopsy as extensively ulcerated nodular malignant melanoma (Figure 3).

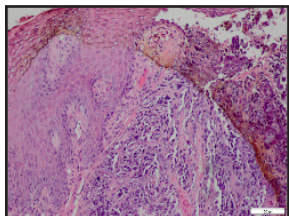


Figure 3. H&E section (40x) of extensively ulcerated nodular malignant melanoma with prominent reddish macronuclei in tumor cells. Areas of pigmentation are also visible.

*Image provided courtesy of pathologist. Jean E. Thomas, MD, Mercy Health– St. Vincent Medical Center, Toledo, OH*

Oncology and palliative care were consulted. A non-contrast CT chest was completed that demonstrated no pulmonary nodules or masses, but did reveal changes consistent with atelectasis, meaning there was partial collapse of both of his lungs. The Lactic Acid Dehydrogenase blood test (LDH) ordered for cancer staging was notably elevated at 238. Treatment options were discussed in detail with the patient, including amputation and complete work up (e.g., determination of driver mutational status) versus palliative care. The patient and his daughter elected to change code status to DNR-CC, meaning “do not resuscitate” and “comfort care” only. He was discharged to hospice on the sixth day of admission with oral antibiotics and rivaroxaban, a blood thinner for the chronic DVT. Mr. DS expired 10 days later.

## Case Study #2

Mr. RW, 76-years old, married, and retired, presents to his PCP with complaint of left heel pain associated with a non-healing wound. He denied history of cancer and relates slow growing mass on the outside of

his left heel for greater than one year. He was placed on antibiotics by his PCP, who arranged for initial podiatric evaluation the next day. His ulcerative skin measured 3.5cm x 5.0cm x 1.5cm and was dark black and nodular in appearance (Figure 4). The border was highly asymmetrical and irregular, concerning for malignant nodular melanoma. The patient consented to having a punch biopsy performed in the office under local anesthesia. The specimen was sent to pathology marked as “urgent” priority.



Figure 4. “Non healing wound” referred to podiatry.

Pathology confirmed diagnosis of malignant melanoma, prompting referral to UVA oncology where he was seen promptly. Mr. RW completed an MRI that demonstrated a pedunculated (stalk-like), cutaneous nodule without evidence of underlying subcutaneous extension. He then completed a full body PET/CT scan for melanoma extending from head to toe. Fortunately, advanced imaging did not reveal locoregional or distant metastatic disease. Thus, he was found to have melanoma *in situ* of the left lower extremity, allowing him to undergo resection of the malignant tissue by plastic surgery. At his last follow up, he had fortunately not required a below knee amputation, and instead, the wound defect resulting from excision of the melanoma had been successfully covered by a muscle flap.

## Conclusion

Podiatric care is appropriate not only for various common conditions, but also for potentially life-threatening conditions. The above cases illustrate late diagnosis of malignant nodular melanoma that presented in the lower extremity. The value of shoe and sock removal during physical examinations is demonstrated. Clinical evaluations were highly suggestive of melanoma in each case; however, biopsy was essential for confirmation of diagnosis prior to referral to oncology.

## Study Questions

1. What assistive devices or home care options may be provided to older adults to assist in skin cancer screenings?
2. What signs and symptoms should patients look for while screening themselves for skin cancer?
3. Name other benefits to regular lower extremity surveillance.
4. What are the most frequent issues faced by older adults and why is it important that problems be addressed?

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