The Diabetic Foot Ulcer: Harry's Toe Trauma

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The development of a foot ulcer in a patient with diabetes is associated with significant morbidity and in 15% of cases may lead to amputation. The ideal situation would be to identify those patients who are at risk for development of that ulcer and implement a plan of care that would potentially reduce that risk.

Ulcer development is associated with neuropathy and vascular insufficiency. But these two factors alone do not explain why some patients appear to be at greater risk for ulcer formation. The combination of neuropathy, foot deformity and foot trauma together make the most significant contribution to ulcer development.

Assessment of the feet of the person with diabetes may uncover some features that should be followed closely. Table 1 lists those features that would be helpful to document during one of the initial patient visits.

Neuropathy

Neuropathy can be tested and documented in many different ways, but the use of monofilament testing at 10 sites is fairly reliable as an indicator of sensory neuropathy. Monofilament testing results are recorded as the number of negative sites indicating that the higher the number, the greater the neuropathy. Further information about monofilament testing is available at the Canadian Association of Wound Care web site at www.cawc.net <http://www.cawc.net>

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Harry's case

- Harry, 57, has had Type 2 diabetes mellitus for 10 years
- He is currently on metformin and glyburide
- He was followed by another physician prior to moving to your area
- He has brought a list of his recent blood sugars, as well as results of arterial dopplers of his lower legs that show no abnormality except minimal occlusion of the vessels below his knees
- He came to your office today because he noticed that his toe nails were dark
- On examination of his feet, you notice that he has reddish areas over several of the joints of his toes, as well as blackened toenails on each great toe (Figure 1)
- He has toe web maceration and fine scale along the sides of his feet
- Monofilament testing shows right foot -7/10 and left foot -8/10 indicating significant loss of sensation
- Pulses are palpable and his BP is normal
- His shoes are new and Harry assures you that they "fit just fine"

What should you suggest to Harry?

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Figure 1. Signs of trauma on the toes of a patient with diabetes.

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Table 1

Initial assessment: Features to document

- Foot Deformity
- Foot trauma
- Shoe Wear
- Neuropathy
- Vascular status
- Calluses or cracks
- Toe web maceration
- Open areas/blisters
- Previous ulcer/amputation

Foot deformity

Patients may have bony deformities of the feet that are related to old trauma, or inflammatory conditions leading to a fixed joint or uneven weight bearing. With the progression of the neuropathy associated with diabetes, deformities that include claw foot and hammer toes will be frequent. Neuropathic osteoarthropathy (Charcot joint) is less common but represents a more challenging problem. Foot deformities and uneven weight bearing in the insensate foot will lead to pressure imbalance and subsequent ulcer formation.

Foot trauma and shoe wear

Shoes that are either too big, or too small are frequently worn. Patients with sensory neuropathy cannot assess their own shoe fit and consequently tend to buy a fixed size, without consideration of the change in shape of their foot. The ideal shoe has:

- a closed toe,
- good arch support,
- a high toe box and ties up, or
- uses a fabric hook-and-loop close.

Also, the length and width must be appropriate, *e.g.,* not too small to cause crowding and not too big to cause slipping, shear or friction. Custom shoe wear and orthotics are not always affordable, but a sensible, well fitting walking or running shoe is often a very reasonable and appropriate alternative.

Vascular status

Palpable pulses may not always indicate good vascular supply. Non-invasive vascular studies, including dopplers would be helpful to determine the vascular status of the lower limb in the patient with diabetes. A timely referral to a vascular surgeon and medical management of vascular insufficiency may reduce future lower limb ischemic events.

Skin changes on the feet

Excess callus formation, especially in unexpected locations, such as the sides of the toes, suggests uneven weight bearing. Hemorrhagic callus needs to be removed to determine if there is underlying skin breakdown. Cracks and fissures, especially along the sides of the foot and the heels are sites of potential ulcer formation and secondary infection. Regular foot care by a chiropodist, nurse practitioner or other health care provider can reduce this callus and thickened skin on the heels (Figure 2 and Figure 3).

Toe web maceration and fine scale along the sides of the feet may represent Tinea pedis. Confirmation of the diagnosis with a culture and treatment with a topical antifungal agent is usually indicated.

Nails may be hypertrophic, or dystrophic and may be onychomycotic. The nail bed underneath thickened nails is a site for ulcer development. Pincer nails, uneven nails and ingrown nails are also sites of trauma where ulcers form. Patients with diabetes may have problems looking after their toe nails and are encouraged to have a care giver, or health care practitioner help in this area.

Figure 2. Callus, hemorrhage, nail dystrophy and toe deformity.

Harry's case cont'd

- You point out to Harry that his reddened toes and black nails show that his shoes may not be the right shape or size and recommend that he try and replace them with a pair from a shoe store in the area that specializes in fitting people with diabetes
- You culture the toe web maceration and while the culture is pending, start him on a topical antifungal such as clotrimazole or terbinafine
- Harry says that his wife will want to know what you told him, so you give him an enabler about the care of the feet of the person with diabetes and suggest that he and his wife go over this
- Also, on this enabler are signs to look for while Harry inspects his feet on a daily basis. You re-assure Harry that he doesn't have a problem right now, but if any suspicious areas develop he should contact your office
- You recommend that he return in the near future to have his feet re-examined
- During that visit his shoe wear can be checked and the possible progression of any of the signs of foot trauma that was previously documented

Take-home message

1. Regular foot inspection by the patient and healthcare practitioner may pick up early signs of foot trauma
2. Shoe wear should be inspected and reviewed. Appropriate shoe wear can be purchased at stores that cater to people with diabetes
3. Close attention to dryness, blisters, cracks, fissures and maceration will control sites for potential ulcer development

Figure 3: Results of shear and friction on the plantar foot.

Previous ulceration or amputation

A person with diabetes who has had a previous ulcer or amputation secondary to a non-healing ulcer is at risk of developing a new ulcer. Approximately one-half of patients who have had a below knee amputation will require an amputation on the remaining side within five years. Such patients need to be followed closely to try and prevent these problems.

Prevention

Patient education has always been a part of the care and management of the person with diabetes, though the benefit in foot ulcer prevention remains difficult to confirm. Despite this, the use of patient enablers and web sites about proper foot care is encouraged. Glycemic control and smoking cessation are general principles that apply to the global care of the person with diabetes.

Regular foot inspection by the primary health care provider is beneficial to detect early signs of excess foot trauma. Dryness, cracks, calluses and fissures require close follow-up to ensure that more significant problems do not develop in these areas. Treatment of tinea pedis and routine nail care will help control those potential sites of ulcer formation. Attention to shoe wear can significantly reduce foot trauma.

Patient accessibility to their health care provider may help to prevent progression of a hemorrhagic blister or callus into an ulcer. Encouraging the patient to examine their feet on a daily basis will only be of benefit if they can report problems and be seen in a timely fashion. Close attention to the feet by the patient and the practitioner will identify those areas at risk, so that deep, chronic ulcers are less likely to develop.

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