The diabetic foot: how to assess the risk?


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Patients with diabetic foot infections present a challenge beyond the expertise of a single field of medicine. Collaboration between multiple specialties is necessary, as well as rapid assessment of the diabetic foot. In 2014, an interdisciplinary team of vascular and podiatric surgeons put forth the new classification focusing on the Wound, Ischemia and Foot Infection (WIFI). The WIFI classification system combines three separate assessments into a combined result allowing for directed care and treatment based upon a consensus-based classification system. It also provide both simplified and dynamic risk assessment.

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Although frequently ignored, the lower extremity with diabetes conceals a silent and sinister syndrome that only recently has begun to garner the spotlight it deserves. The Center for Disease Control and Prevention (CDC) published data in 2014 detailing the overwhelming costs and statistics associated with the burden of diabetes (CDC, 2014). In 2014, it was estimated that every day in the United States, an expenditure of $670 million was made for diabetes management and related care; 5,000 new diagnosed cases of diabetes were made; and 200 limbs were amputated. The diabetic foot is now, by some direct costing measures, more expensive than the top five most expensive cancers (Barshes et al, 2013; Armstrong et al, 2017).

Indeed, outcomes are often worse than all but the most malignant cancers, with 5-year mortality rates (conservative estimate) and more than 50% for people receiving amputations (Armstrong et al, 2017). Once the wounds have healed, recurrence is common — 40% after 1 year, 66% at 3 years, 75% at 5 years, and between 80% and 100% after a decade. Indeed, when these patients heal, are they fully healed or are they really in remission? (Armstrong et al, 2017).

While this problem is similar in some ways to cancer and there is a link between cancer and type 2 diabetes (Vigneri et al, 2009), it is rare that the morbidity and mortality of the diabetic foot are discussed in similar terms as cancer. It has been proposed that care models and care language for the diabetic foot echo the field of oncology, analogous to the tumor, node, metastasis (TNM) system for cancer staging. The aim is to illuminate this growing problem in the public consciousness and spur further research for the diabetic foot (Sanders et al, 2010).

Medical management of the diabetic foot has evolved away from a care model where a solo practitioner provides care, into a model whereby a referral network of primary care physicians works closely with specialists, including podiatrists. Previous research has shown that care of the diabetic foot is best optimised using a multidisciplinary approach (Giovannucci et al, 2010). Over the past 15 years, podiatry has stepped up to take a position on the multidisciplinary team in the care of the diabetic foot. Most treatment care models put the podiatrist at the end of the referral chain, resulting in many patients seeing the

podiatrist later, when a diabetic foot develops a serious problem beyond the expertise of the primary care physician. This often results in late involvement of the podiatrist and this delay can result in poorer outcomes compared with early referral.

An improved variation of such a model has evolved for the diabetic foot (to be discussed in this article), which puts the podiatric surgeon and the vascular surgeon into a partnership called 'Toe and Flow', which allows for a centralised model of management for the lower extremity and facilitates involvement of other specialists when needed. This Toe and Flow team works closely with the primary care physician to assess diabetic foot 'risk' and manage complications as early and rapidly as possible, with the goal being to minimise complications. This model has been instituted in many centres worldwide and continues to generate success in management of the complexities of the diabetic foot. The Toe and Flow integrated team approach has proven to be successful. Faster assessment means faster clinical decision making for treatment and results in better outcomes as time is often the enemy in critically ischaemic, infected patients.

Another barrier to rapid assessment and response to the diabetic foot is an appropriate classification system unique to the condition that also reflects its hidden and ever-changing nature. The preferred classification system for assessment would allow for medical professionals within a hospital, city or country to share a common language. This classification system would even allow for sharing of information based upon a shared frame of reference around the world. This prevents reinvention of treatments, promotes the sharing of both successes and failures, and allows for higher success rates among medical professionals. The growing shared pool of successful treatment methods attached to common assessment allows increased sharing across borders. Even those practicing remotely would have access to successful treatment methods based upon a shared, common language assessment modality. When treating the diabetic foot, faster assessment allows for faster treatment, which can aid in tissue salvage and successful management of the critical patient.

Parallel to the institution of the Toe & Flow model, a simple yet powerful classification system for the diabetic foot was established to aid in the collaborative effort by podiatrists and vascular surgeons. In 2014, an interdisciplinary team of vascular and podiatric surgeons put forth this new classification focusing on the Wound, Ischaemia, and Foot Infection (WIFI). This classification system combines three separate assessments into a combined result allowing for directed care and treatment based upon a consensus-based classification system. All one needs to remember for WIFI settings are "non, mild, moderate and severe, or 0–3). This is similar to the 'Tumor, Node, Metastasis' model for oncology, which also relies on four similar settings (Armstrong and Mills, 2013a; Mills et al, 2013). Each of the three aspects has been validated independently and the entire system has been clinically validated on several thousand patients — more than any previous system (Cull et al, 2014; Zhan et al, 2015; Causey et al, 2016; Hoshina et al, 2016).

It is the authors' opinion that the WIFI system, developed by the Society for Vascular Surgery Lower Extremity Guidelines Committee, is superior to other, older diabetic foot ulceration systems of classifications (PEDIS, University of Texas, Wagner). The PEDIS system (Perfusion, Extent, Depth Infection and Sensation) has four factors and a score system; however, it focuses only on ulcers. A diabetic foot may have gangrene (which greatly increases amputation risk compared to ulceration), torturous vein structures, or lack of blood flow — all factors that greatly increase amputation risk compared to ulceration. The Wagner-Meggitt's classification was developed in the 1970s and focuses only on grading lesions in the diabetic foot with five grades of classification. The last two stages describe forefoot gangrene and rear foot gangrene, the most severe of ischaemic conditions.

The University of Texas Diabetic Wound Classification, while well known, validated, and generally predictive of outcome, has four stages and three grades. It does not reflect the presence of gangrene or other diabetic foot outcomes, does not have a grading system for peripheral artery disease (PAD) or infection, and treats only conditions relevant to podiatry. All are hard to understand and difficult to communicate to specialists outside of podiatry.

Recent research has shown that an increase in temperature in a localised area of the diabetic foot presages the event of an ulcer, even though the skin surface is unbroken. None of these three classifications takes the presence of incipient infection into account. The WIFI system addresses this variable. WIFI can also be used to describe the state of the diabetic foot in remission or in need of additional intervention,

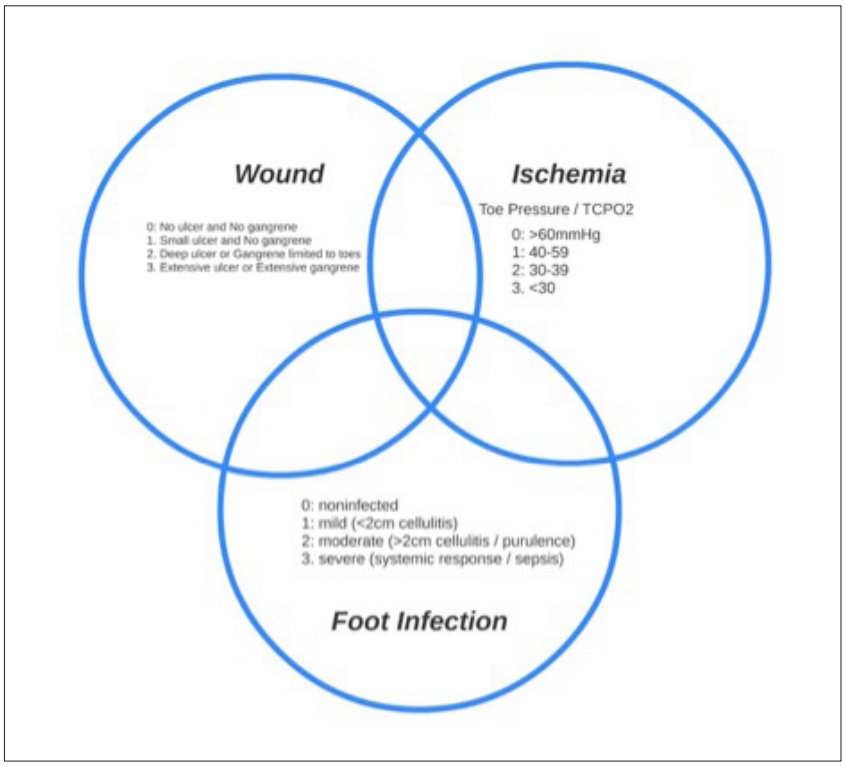

Figure 1. The three intersection rings of risk help identify which risk is 'dominant' at any given time during a lifetime of care (Armstrong and Mills, 2013a).

standardises outcome comparisons for accurate analysis and integrates the key factors affecting tissue loss.

For proper risk assessment, the overall assessment needs to fully appraise the diabetic foot, which can be evaluated by three criteria. The criteria can be assessed with a philosophy that allows dynamic inclusion of three intersecting rings. The three-ring model *[Figure 1]* allows one ring to become dominant, if needed, during the course of patient treatment if the assessed condition changes.

These rings involve tissue loss, ischaemia, and infection. In terms of the former, wound assessment is usually the first step in risk assessment of the diabetic foot. Therapy usually involves appropriate debridement, offloading and a wound dressing. After healing has occurred, subsequent patient care focuses on protection of the remaining tissue via external means (shoes, insoles, medical monitoring of inflammation) or internal means (reconstructive surgery, physical therapy) (Arad et al, 2011; Armstrong and Mills, 2013b). Ischaemia, meanwhile, must be primarily addressed to effect wound healing. This involves vascular assessment and a strategy for either monitoring or intervention (Mills et al, 2001). Infection assessment needs to be made in the presence of an infected wound, or in the case of a healed wound demonstrating cellulitis (Fisher et al, 2010; Lipsky et al, 2012).

When patients present for care, risk assessment is made by grading the patient upon the three criteria of the WIFI system. This rubric assists interdisciplinary discussions about what ring(s) might be most dominant at any time and should garner the focus of attention. This risk assessment strategy allows for focused treatment and continued reassessment if and when conditions change and the focus of treatment/management must be modified. Often, patients may experience non-healing due to recurrent ischaemia or the presence of a new infection. Risk reassessment is both simplified and dynamic using the WIFI system.

Ulcer remission is the goal of remediating the diabetic foot, much as oncologists attempt to achieve cancer remission. Wound closure is seen as being a lessening in the seriousness of the condition or a respite, rather than being healed. The framework of remission is also more appropriate for organising care and resources, as well as communicating risk. For those wounds that do not heal or for whom healing poses an undue burden of medical or social burden, a palliative approach that reduces the complexity of care may be preferable.

While diabetic foot patients are in remission, they should be monitoring themselves to aim for more ulcer free days. In this respect, WIFI restaging can also be used to find out how the diabetic foot has responded to treatment and predict whether amputation-free survival is possible or if additional intervention is necessary. As with the TNM cancer classification, a new stage in the condition of the diabetic foot can be marked with an 'R' to show that it is different from the original stage.

In the Tumor Node Metastasis model, the 'r' (note lower case) indicates "stage for a recurrent tumor in an individual that had some period of time free from the disease" versus 'R' (note upper case), which indicates completeness of the procedure so that the boundaries occupied by the tumor are free of cancer cells (Wittekind et al, 2002).

Restaging can assist with developing the best plan for a diabetic foot that has a new problem or a problem that has gotten worse.

Patients with diabetic foot infections present a challenge beyond the expertise of a single field of medicine. Collaboration between multiple specialties is necessary. Working in tandem, the vascular surgeon and podiatric surgeon create the Toe and Flow team to focus on blood flow to the foot and on the presence of wounds, ischaemia and infection. In addition to the podiatric surgeon and vascular surgeon, the

team may also include a specialist in infectious disease, a plastic surgeon, diabetologist, orthopaedic surgeon, and a general surgeon, as well as a pedorthist/prosthetist involved in fitting necessary devices. The WIFI classification enables these disciplines to communicate their shared concern for the diabetic foot. The WIFI classification system is easy to remember and can be adapted as the foot worsens or goes into remission. The application of the WIFI classification system for the threatened limb system allows for guided treatment with assessed risk. It also allows for improved communication between podiatrists and other specialists. The Toe and Flow model team can then work closely and often simultaneously on critical patients.

The WIFI classification system also allows triage of the patients so more severe cases can be addressed rapidly. This assessment allows for a division of labour to treat all factors collaboratively. With the end goal of patient care in focus, proper assessment allows for improved outcomes. The sharing of successful treatment methods based upon a common assessment method develops a foundation that collaborative success can be built upon. WINT

Further information

A free WIFI risk calculator is available for download here: *https://diabeticfootonline.com/2015/09/15/download-the-wifi-threatened-limb-score-theres-an-app-for-that/*

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