

Stay classy: the classification of diabetic foot ulcers and its relevance to management: part 1

Matthew Young and Duncan Stang

Citation: Young M, Stang D (2018) Stay classy: the classification of diabetes foot ulcers and its relevance to management. *The Diabetic Foot Journal* 21(1): 52–5

Article points

1. Classification in important
2. Classification requires a full examination of the foot and the person with the ulcer
3. Classifications should applied at the first presentation and the ulcer is described at later visits.

Key words

- Classification
- Diabetic foot ulcers
- Management

Authors

Matthew Young is Consultant Diabetologist, Department of Diabetes, Royal Infirmary, Edinburgh;
Duncan Stang is Specialist Diabetes Podiatrist and National Diabetes Foot Co-ordinator for Scotland

Classification is the cornerstone of diabetes foot ulcer care. Assessing the foot and documenting the characteristics of that ulcer in a systematic way ensures that all the relevant characteristics that can affect healing are detected and recorded. In addition, classification also allows for meaningful comparisons of outcomes between centres. While there are differences between the various classification systems in use, even within the UK, they share common characteristics and the merits of each will be discussed in a later article.

The management of diabetic foot ulceration should be multidisciplinary and this requires effective communication between primary and secondary care. In addition, the increasing role of research-based practice, audit and clinical effectiveness in the provision of healthcare means that accurate and concise ulcer description and classification is required to improve interdisciplinary working and to allow meaningful audit and comparisons between centres.

The classification of an ulcer identifies a single type of ulcer with definable characteristics, which are different from other ulcer categories. As well as being the basis for clinical care, a classification should provide a guide to prognosis and facilitate audit and research. A good example would be to classify ulcers by their suspected aetiology, such as neuropathic or neuroischaemic, or by the perceived severity, for example, superficial or deep. The classification of an ulcer should be applied once, based on the initial characteristics, and not alter with the progress of therapy. Treatment plans and outcomes based on initial classification should be the purest form of clinical audit in ulcer care (Apelqvist et al, 1989).

An ulcer description can also be based on definable characteristics, but differs from a classification in that a description applies to the ulcer at the moment it is described. It is, therefore, ephemeral and changes with

the progression of the ulcer. While descriptive terms, such as uninfected or infected, are used to classify patients, most descriptive terms are too numerous to make a workable numbers of categories, but are used to prompt adjustments to treatment as the nature of the ulcer changes.

Categories for classification and description of ulceration

Location of the ulcer

It is essential to describe the site of ulceration as this will often give clues as to the causation, and often the underlying aetiology, for the purpose of guiding therapy. Toe ulceration is usually directly shoe induced, plantar ulceration is often multifactorial. Plantar ulceration is classically neuropathic, marginal ulcers are more commonly associated with ischaemia. In addition, toe ulceration is significantly associated with amputation. Therefore, the location of ulceration can also give a guide to prognosis (Isakov et al, 1999)

Ulcers which are formed in association with significant foot deformity are rarely characterised separately from other ulcers. Deformity forms the basis of a number of foot ulcer risk scoring systems, but once the ulcer has formed, has received little attention as a guide to treatment or prognosis. Only Mayfield et al (1996) identified deformity as an additional risk

factor for amputation, but this was as part of a pre-ulceration risk stratification and not as a direct result of classifying ulcers.

Size and extent of ulceration

The size of an ulcer, usually defined as either two transverse diameters at right angles, or as surface area, is an important descriptive term and without serial measurements of ulcer size it is impossible to document change in any meaningful way and should be mandatory.

The volume of an ulcer is difficult to assess without specialist equipment (Romanelli et al, 2008). However, ulcer depth is an important factor in both descriptive and classification systems. The use of sterile, blunt probes to fully explore the extent of an ulcer is a useful tool to identify bone and deep tissue involvement in ulcers. The identification of deep tissue involvement and, in particular, deep infection or osteomyelitis, is strongly associated with an increased risk of major amputation and, therefore, should be assessed in all ulcers.

Aetiology

The management of ulceration, pressure relief, debridement and infection control is varied depending on the nature of the ulcer. The requirement for revascularisation is only present in those with peripheral arterial disease, which significantly increases the risk of amputation compared to neuropathy. Patients with neuropathy who develop foot ulcers have a significantly better prognosis than patients with vascular insufficiency. Study after study has highlighted the additional amputation burden of patients with adverse circulatory parameters. An ulcer that is not healing despite optimal care should be investigated for vascular insufficiency (Prompers et al, 2008).

The coexistence of neuropathy in patients with peripheral vascular disease (Hoeldtke et al, 1994) has led to the use of the description the neuroischaemic foot. Some patients with peripheral vascular disease have intact peripheral sensation and can experience pain during ulcer debridement or with infection. Pain is a bad prognostic indicator because of this (Apelqvist et al, 1990).

The presence of gangrene is the significant. However, localised gangrene in the toes can occur as a result of infective vasculitis in a foot with normal

peripheral pulses, and the presence of tissue necrosis and gangrene in infected feet is not always as a result of a failure of peripheral circulation. Resection of infected tissue necrosis or toe autoamputation may allow a foot to heal appropriately without major amputation in an otherwise well-perfused limb. Extensive gangrene, either from peripheral arterial occlusion or infection usually leads to major amputation. However, it is not clear how much gangrene constitutes extensive. While it might appear clinically obvious when a foot needs amputating, the wide disparity in amputation rates between centres suggests that a stricter definition might be required.

Infection

Infection has a significant adverse effect on the diabetic foot with ulceration. The Infectious Diseases Society of America classification sets out clear criteria for infection. However, these signs can be subtle and need to be looked for in every ulcer (Lipsky et al, 2012).

Characteristics of the whole patient

There are a number of patient characteristics which have a significant effect on the outcome of diabetic foot ulceration. A history of previous foot ulceration, or amputation, indicates a high risk of amputation during this event. One of the reasons for this is the strong association between patient non-compliance with therapy and amputation in a number of studies. Inability to comply with offloading strategies, antibiotic therapy and failure to attend clinic will all compromise the foot. In addition, late presentation to clinic with an ulcer carries a high risk of subsequent amputation, although this may be as much due to primary care delays as patient delays (NHS Digital, 2017).

It is more common for men to have foot ulcers and to have amputations. Older people, especially if they live in institutionalised care or have a low walking tolerance, and patients with longer duration of diabetes are at greater risk of major amputation (Larsson et al, 1995). Amputation risk is generally higher in patients with other major diabetes complications, particularly renal impairment (Margolis et al, 2008).

Type II patients on insulin, higher glycated haemoglobin and random glucose levels are also associated with a greater risk of amputation or reulceration in some studies and may again reflect a degree of patient compliance with therapy (Mantey et al, 1999).

Page points

1. The characteristics of an ulcer that influence outcomes.
2. Numerous studies have highlighted the additional amputation burden of patients with adverse circulatory parameters.
3. Infection has a significant adverse effect on diabetic foot ulceration.

The myth of the non-healing ulcer?

Many studies have tried to categorise the non-healing diabetic foot ulcer. A static would after four or six weeks is a common definition (Warriner et al, 2011) but as the National Diabetes Footcare Audit (NDFCA) (NHS Digital, 2017) has recently highlighted, outcomes start to get worse after 2 weeks of referral delay to a specialist foot service.

The value of classification systems in clinical practice

In general, descriptions are more detailed and apply to individuals, while classifications are pigeon holes in which to place groups of patients for research and audit. Individuals within the same classification grade will have other characteristics, principally the presence or absence of other diabetes complications, diabetic control, social factors and treatment compliance levels, which alter their treatment and outcome but, in general, increasing severity of ulceration influences prognosis and amputation rate. Therefore, treatment decisions have to be made on an individual basis (Larsson et al, 1995).

The value of scoring and grading systems in planning treatment is that they prompt the clinician to search for the depth of the ulcer, to consider whether infection is present and to seek evidence of vascular insufficiency. Thus, by using a scoring or grading system the care of the patient is improved simply because all the major relevant factors in the healing of the ulcer are considered. For this reason alone, it should be the standard practice for all clinicians treating diabetic foot ulcers to adopt a classification system. Ultimately, were all clinicians to use one classification it would allow audits to be corrected for case mix and enable a look at process and outcome based purely on treatment. In Scotland, the Texas classification (Lavery et al, 1996) is built into the The Scottish Care Information — Diabetes Collaboration (SCI-Diabetes) ulcer management system. In the NDFCA, the SINBAD system has been adopted. Both have their merits and these will be discussed in a subsequent article.

Conclusions

The use of classifications ensure a systematic approach to the evaluation of patients with foot ulceration. This, in turn, leads to improved treatment on basis

of a full and thorough assessment. If the classification system that is adopted does not take into account patient factors, such as comorbidities, social factors, and levels of treatment compliance, then some local arrangements should be made to ensure that these are not overlooked. Following a care plan based upon the patient's classification should not preclude regular reassessment, particularly if the ulcer is not healing as expected. The truly non-healing neuropathic ulcer probably does not exist, but failures in care still do. Finally, the use of a robust and validated classification system will greatly aid in the audit of meaningful outcome data so that standards can be improved and the NDFCA and data extracted from the SCI Diabetes system should help to improve care nationwide. ■

- Apelqvist J, Castenfors J, Larsson J et al (1989) Wound classification is more important than site of ulceration in the outcome of diabetic foot ulcers. *Diabetic Med* 6(6): 526–30
- Apelqvist J, Larsson J, Agardh C-D (1990) The importance of peripheral pulses, peripheral oedema and local pain for the outcome of diabetic foot ulcers. *Diabetic Med* 7(7): 590–4
- Hoeldtke RD, Davis KM, Hsieh PB et al (1994) Are there two types of diabetic foot ulcers? *J Diabetes Comp* 8(2): 117–25
- Lipsky BA, Berendt AR, Cornia PB et al (2012) 2012 Infectious Diseases Society of America clinical practice guideline for the diagnosis and treatment of diabetic foot infections. *Clin Infect Dis* 54(12): e132–73
- Ince P, Abbas ZG, Lutale JK et al (2008) Use of the SINBAD classification system and score in comparing outcome of foot ulcer management on three continents. *Diabetes Care* 31(5): 964–7
- Isakov E, Budoragin N, Shenhav S et al (1995) Anatomic sites of foot lesions resulting in amputation among diabetics and non-diabetics. *Am J Phys Med Rehabil* 74(2): 130–3
- Larsson J, Agardh CD, Apelqvist J, Stenstrom A (1995) Clinical characteristics in relation to final amputation level in diabetic patients with foot ulcers: a prospective study of healing below or above the ankle in 187 patients. *Foot Ankle Int* 16(2): 69–74
- Lavery LA, Armstrong DG, Harkless LB (1996) Classification of diabetic foot wounds. *J Foot Ankle Surg* 35(6): 528–31
- Mantey I, Foster AV, Spencer S, Edmonds ME (1999) Why do foot ulcers recur in diabetic patients? *Diabetic Med* 16(3): 245–9
- Margolis DJ, Kantor J, Berlin JA (1999) Healing of diabetic neuropathic foot ulcers receiving standard treatment; A meta-analysis. *Diabetes Care* 22(5): 692–5
- Margolis DJ, Hoifstad O, Feldman HI (2008) Association between renal failure and foot ulcer or lower-extremity amputation in patients with diabetes. *Diabetes Care* 31(7): 1331–6
- Mayfield JA, Reiber GE, Nelson RG, Greene T (1996) A foot risk classification system to predict diabetic amputation in Pima Indians. *Diabetes Care* 19(7): 704–9
- NHS Digital (2017) *National Diabetes Foot Care Audit Report 2014–2016*. Available at: <http://www.content.digital.nhs.uk/catalogue/PUB23525/nati-diab-foot-care-audit-14-16-rep.pdf> (accessed 25.01.2018)
- Prompers L, Schaper N, Apelqvist J et al (2008) Prediction of outcome in individuals with diabetic foot ulcers: focus on the differences between individuals with and without peripheral arterial disease. The EURODIALE Study. *Diabetologia* 51(5): 747–55
- Romanelli M, Dini V, Rogers L et al (2008) Clinical evaluation of a wound measurement and documentation system. *Wounds* 20(9): 256–64
- Warriner RA, Snyder RJ, Cardinal MH (2011) Differentiating diabetic foot ulcers that are unlikely to heal by 12 weeks following achieving 50% percent area reduction at 4 weeks. *Int Wound J* 8(6): 632–7

Online CPD activity

Visit www.diabetesonthenet.com/cpd to record your answers and gain a certificate of participation

Participants should read the preceding article before answering the multiple choice questions below. There is ONE correct answer to each question. After submitting your answers online, you will be immediately notified of your score. A pass mark of 70% is required to obtain a certificate of successful participation; however, it is possible to take the test a maximum of three times. A short explanation of the correct answer is provided. Before accessing your certificate, you will be given the opportunity to evaluate the activity and reflect on the module, stating how you will use what you have learnt in practice. The new CPD centre keeps a record of your CPD activities and provides the option to add items to an action plan, which will help you to collate evidence for your annual appraisal.

1. Which is the SINGLE MOST common anatomical site to be affected by direct shoe-induced ulceration? Select ONE option only.
 - A. Calcaneal
 - B. First metatarsal head (plantar)
 - C. Fifth metatarsal head (lateral)
 - D. Medial malleolar
 - E. Toe

2. Ischaemic foot ulcers are MOST LIKELY to occur at which SINGLE anatomical site? Select ONE option only.
 - A. Dorsal
 - B. Heel
 - C. Marginal
 - D. Plantar
 - E. Toe

3. A 57-year-old man with type 2 diabetes has a neuropathic foot ulcer.

Which is the SINGLE MOST appropriate method to assess whether his foot ulcer is changing (progression or resolution)? Select ONE option only.

 - A. Doppler blood flow recordings
 - B. Monofilament testing
 - C. Pain scores
 - D. Patient self-assessment of progress
 - E. Serial measurements

4. Which is the SINGLE MOST appropriate primary care assessment of foot ulcer volume, if any? Select ONE option only.
 - A. Depth using a blunt probe
 - B. Digital photography
 - C. Foot X-ray
 - D. Not available in primary care
 - E. Surface area measurement

5. A 64-year-old woman with type 2 diabetes has attended several practice nurse wound dressing appointments but now has a non-healing foot ulcer. Her HbA_{1c} is 58 mmol/mol and there is no evidence of impaired foot sensation.

Which is the SINGLE MOST appropriate INITIAL investigation. Select ONE option only.

 - A. Doppler blood flow recordings
 - B. Random blood sugar
 - C. Skin biopsy
 - D. Urine albumin:creatinine ratio
 - E. X-ray

6. A 69-year-old man with type 2 diabetes has a left foot ulcer.

Which ONE of the following conditions, if present, MOST significantly INCREASES his risk of amputation? Select ONE option only.

 - A. Cellulitis
 - B. Peripheral arterial disease
 - C. Peripheral neuropathy
 - D. Vasculitis
 - E. Venous hypertension

7. According to Warriner et al, 2011, what is the MAXIMUM time (in weeks) before stating that a diabetic foot ulcer is 'non-healing'? Select ONE option only.
 - A. 2
 - B. 4
 - C. 6
 - D. 8
 - E. 12

8. Which ONE of the following is the MOST appropriate clinical method to assess the depth of a non-healing diabetic foot ulcer? Select ONE option only.
 - A. Blunt probe
 - B. Gloved finger
 - C. Ruler
 - D. Ultrasound
 - E. X-ray

9. A 39-year-old man with type 1 diabetes has developed two superficial ulcers on the dorsum of his left foot in association with several raised purpuric papules. His HbA_{1c} is 59 mmol/mol, BMI 26 and renal function normal. On examination, his foot pulses and skin sensation is normal.

Which is the SINGLE MOST likely cause of his foot ulceration? Select ONE option only.

 - A. Peripheral arterial disease
 - B. Peripheral neuropathy
 - C. Poor shoe fitting
 - D. Vasculitis
 - E. Venous hypertension

10. Which is the SINGLE MOST appropriate primary care method to document the size of a diabetic foot ulcer? Select ONE option only.
 - A. Circumference
 - B. Comparison to coin size
 - C. Comparison to fruit size
 - D. Two transverse measurements
 - E. Volume