

Simple Staging System: a tool for diagnosis and management

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ARTICLE POINTS

1 A staging system should record significant events, avoid overlap, and be simple, quick and easy to apply.

2 The Simple Staging System has been developed, based on the natural history of the diabetic foot.

3 The system can be used to stage the foot and as a guide to management at each stage.

4 Researchers may wish to use the system as a framework and then extend it as appropriate.

KEY WORDS

- Simple Staging System
- Diabetic foot
- Significant events
- Control

Introduction

The Simple Staging System has been developed to provide a framework for diagnosis and management of the diabetic foot. It is based upon the natural history of the diabetic foot on the road to amputation. This article describes the rationale for the development of the system, summarises its six stages, and outlines the ways in which it can be used as a basis for clinical decisions about diabetic foot care.

The aim of a staging system for the diabetic foot should be to describe the foot in a meaningful way which will be of use in making clinical decisions, communicating between healthcare professionals and conducting research.

There is no consensus as to which system should be used for staging diabetic foot lesions. Probably the most widely used system worldwide is the Wagner system (1981): the brainchild of a surgeon, which is not based upon the natural history of the diabetic foot but can be applied to any ulcerative foot pathology.

We have recently developed a 'Simple Staging System' which was launched in November 1999 (Edmonds and Foster, 2000). It is one of three recently developed systems; the other two are the San Antonio system (Armstrong et al, 1998) and S(AD) SAD (Macfarlane and Jeffcoate, 1999). The development of these new systems indicates that there is an urgent need for a new staging system for the diabetic foot covering factors which are not included in the Wagner system.

When developing the Simple Staging System careful consideration was given to what the system could be used for, the factors which should be included, and the potential dangers and advantages

of staging systems. It was concluded that the new system should:

1. Record significant events, or stages, in the natural history of the diabetic foot on the road to amputation and should use those stages as a framework to help the practitioner decide what clinical care may be necessary at that stage. The events regarded as significant, based on the literature together with our clinical experiences, are shown in *Table 1*.

2. Avoid overlap when describing diabetic feet. Advancement to a later stage should always indicate a significant change in pathology, the associated risks, likely outcomes, and a need for changes in the care provided. The stages in the Simple Staging System move through the low-risk foot, the high-risk foot, the ulcerated foot, the infected foot, the necrotic foot and

Table 1. Significant events in the natural history of the diabetic foot on the road to amputation

- 1** The diabetic foot may have no risk factors for ulceration (stage 1).
- 2** Neuropathy, ischaemia, deformity, oedema and callus are the most well known risk factors for ulceration (stage 2).
- 3** Ulceration is a pivotal event on the road to amputation requiring urgent and aggressive management (stage 3).
- 4** Infection delays healing and can destroy tissue with alarming rapidity (stage 4).
- 5** Necrosis is the result of tissue destruction from infection and ischaemia (stage 5).
- 6** There comes a time when the foot is destroyed and major amputation is inevitable; this is the final stage (stage 6).

lastly, the unsalvageable foot. However, this progression is not inevitable, and the aim is always to keep the foot at as low a stage as possible.

3. Be simple, quick and easy to apply so that people will use it, and use it correctly. An over-complicated system, which people cannot remember easily, will not be used. In the clinic, people do not want to have to refer to charts; they want to be able to stage the foot there and then. People use the Wagner system, even though it is not ideal for describing the diabetic foot, because it is simple, quick and easy to apply.

4. Be suitable for all practitioners dealing with the diabetic foot, whether in the community or the hospital, from practice nurses and community podiatrists, to consultant physicians and surgeons, whether experienced in the management of the diabetic foot or not.

5. Avoid giving false reassurance. The Simple Staging System may be criticised because it does not grade ulcers as 'superficial', 'deep', etc, or infections as 'superficial' or 'severe'. This is because we believe that describing an ulcer or an infection as 'superficial' may lead to loss of a proper sense of urgency on the part of the practitioner and the patient. Any staging system which gives false reassurances will give practitioners an excuse for neglecting the diabetic foot, and such neglect is a common cause of disaster.

6. Be of real practical use in the day-to-day management of the diabetic foot patient, i.e. it can be used as a framework for decisions about clinical care.

Other factors to consider when developing a staging system are:

7. Severity of stage should be reflected by outcomes. It has been suggested that proof of the effectiveness of a staging system is that the more severe the stage reached, the greater the associated morbidity will be and the worse the associated outcomes (Armstrong et al, 1998). Although a useful principle, this may not always be the case because, if the staging system is used as a basis for providing rapid and effective treatment, outcomes may be good even when a high stage is reached.

In designing the Simple Staging System, the two outcomes of diabetic foot

problems that we have regarded as significant are healing and amputation. The higher the stage reached, the worse the outcomes usually are. People without risk factors rarely develop ulcers. Healing time of ulcers is worsened by infection; infection can lead to necrosis, and amputation is rarely necessary in the absence of necrosis.

8. Complicated feet must be categorised as neuropathic or neuroischaemic. Any staging system which is used as a framework for care provision to diabetic foot patients must include the essential distinction between the neuropathic foot and the neuroischaemic foot, because the care offered will often differ according to which of these categories applies.

9. The staging system should be useful for research. It has also been proposed that any staging system must be useful as a research tool, describe wounds in a very detailed way and enable researchers to compare different groups of wounds and their treatment in a meaningful manner (Young, 2000), and this is a laudable objective. However, in order to achieve the other objectives described above it may not be appropriate to go into such detail. An over-complicated, detailed and time-consuming staging process may hamper clinical work.

As it stands, the Simple Staging System is not necessarily a tool for the researcher who wants to go into very fine detail. Those conducting diabetic foot research will probably want to extend the system, e.g. by using the Simple Staging System as a basic framework and, in addition, recording subtle degrees of neurological deficit and ischaemia, probing and tracing ulcers to measure their dimensions accurately, quantify the precise degree and extent of cellulitis and necrosis, etc, and recording the previous duration of lesions.

Other problems

There is a clinical impression that the longer the risk factors have been present the more likely it is that ulceration will occur, and also that the longer an ulcer has been present the harder it is to heal. However, since infection can develop and progress with such alarming rapidity, and there is no evidence that necrosis which has been present for many months has a worse outcome than necrosis

PAGE POINTS

1 A staging system should be suitable for all practitioners.

2 It should avoid giving false reassurance.

3 It should be of day-to-day practical use.

4 It is not always possible for a system to be detailed enough for use for research purposes, yet still simple enough for day-to-day clinical use.

PAGE POINTS

1 The Simple Staging System may act as a useful 'aide memoire' for clinicians.

2 The system emphasises the need for practitioners to apply a checklist to ensure that all aspects of care are covered.

3 A staging system should categorise feet as neuropathic or neuroischaemic.

4 Risk factors include neuropathy, ischaemia, deformity, callus and oedema.

of recent onset, we have not incorporated duration into our staging system.

Potential advantages

A potential advantage of the Simple Staging System is that it can act as an 'aide memoire' for clinicians to ensure that all aspects of taking control of diabetic feet are covered.

There are many facets to managing the diabetic foot successfully. The key is to take control of the mechanical, metabolic, microbiological, educational, vascular and wound aspects. This approach is well supported in the literature relating to the diabetic foot (International Working Group on the Diabetic Foot, 1999). Omission of any of these factors can lead to poor outcomes, and it is important that none of them is overlooked when assessing and treating the foot. The Simple Staging System emphasises the need for practitioners to apply a checklist to ensure that complete control of all these aspects is provided.

The Simple Staging System is both a system for staging the foot and a guide to the management of each stage. Treatment will vary depending on whether the foot is neuropathic or neuroischaemic.

The neuropathic foot

This is a warm, well-perfused foot with loss of sensation secondary to a peripheral neuropathy. Ulceration develops at the sites of high mechanical pressure on the plantar surface of the toes and forefoot during walking. Ulcers are portals of entry for bacteria leading to spreading infection which may present as cellulitis or as wet necrosis.

The neuroischaemic foot

This is a cool, pulseless foot with poor perfusion. It usually also has neuropathy. Ischaemia results from atherosclerosis of the leg arteries, which is often bilateral, multi-segmental and distal, involving arteries below the knee. It is complicated by intermittent claudication, rest pain, ulceration and necrosis. However, intermittent claudication and rest pain may be absent because of the co-existing neuropathy.

In contrast to neuropathic ulcers, neuroischaemic ulcers develop directly on the margins of the foot and toes, on sites that are made vulnerable, by underlying

ischaemia, to the moderate but continuous pressure from poorly fitting shoes. These ulcers can be complicated by infection and by wet and dry necrosis.

Staging the diabetic foot

The Simple Staging System covers the whole spectrum of diabetic foot disease but nevertheless emphasises the foot ulcer as a pivotal event demanding urgent and aggressive management. The natural history of the diabetic foot can be divided into six stages, each based on significant events in the development of complications, as follows:

Stage I

The foot is normal and not at risk. The risk factors that render the patient most vulnerable to foot ulcers are absent. These risk factors are neuropathy, ischaemia, deformity, callus and oedema. Stage I patients are identified by screening patients to exclude the five risk factors:

Neuropathy: A simple technique is to use a nylon monofilament which, when applied perpendicular to the foot, buckles at a given force of 10 grams. If the patient does not feel the filament, then protective pain sensation has been lost.

Ischaemia: The most important manoeuvre to detect ischaemia is palpation of the foot pulses. A small hand-held Doppler can also be used to detect pulses, quantify the vascular supply and listen to the quality of the signal.

Deformity: This often leads to bony prominences, which are associated with high mechanical pressure on the overlying skin. This leads to ulceration in the absence of protective pain sensation and when shoes are unsuitable. Common deformities include claw toes, pes cavus, hallux valgus, hallux rigidus, hammer toe, Charcot foot and nail deformity.

Callus: This is a thickened area of epidermis, which develops at sites of high pressure, shear or friction. If allowed to become excessive it leads to ulceration.

Oedema: This is a major factor predisposing to ulceration and often exacerbates a tight fit inside poorly fitting shoes. It also impedes healing of ulcers.

Management of the stage I foot

Mechanical control: diabetic patients

should receive footwear advice regarding the wearing of low heeled, foot-shaped, lace-fastening shoes as much as possible to avoid injury and subsequent deformity.

Educational control: Patients need education about basic foot care, including hygiene, basic first aid techniques and nail cutting.

Metabolic control: Patients should be helped to control the 'Great Quartet' of hyperglycaemia, hyperlipidaemia, hypertension and smoking, in order to prevent or delay the onset of complications (DCCT Group, 1993).

Wound, vascular and microbiological control are not relevant at stage 1. Patients at stage 1 need annual review to ensure early detection of any foot complications.

Stage 2

The foot is now high risk. The patient has developed one or more of the five risk factors for ulceration of the foot. The foot should be carefully assessed, the presence of risk factors ascertained and documented, and from this stage onwards the foot should be classified as neuropathic or neuroischaemic.

Management of the stage 2 foot

Educational control: In addition to providing basic foot care, patients with neuropathy will need special education on the implications of having numb feet and methods to ensure optimal trauma prevention and early detection of problems. Neuroischaemic patients must also be taught how to protect the feet from trauma. All patients need to know the danger signs of deterioration, the dangers of self-assessment and self-treatment, and what to do and where to go if problems arise.

Mechanical control: Callus needs regular removal by sharp debridement by a podiatrist. Special shoes and insoles can reduce callus formation and subsequent plantar ulceration in the neuropathic foot. Deformed feet may need to be accommodated in bespoke shoes. Ischaemic patients need extra-depth, wide-fitting shoes to protect the vulnerable margins of the feet.

Metabolic control: It is still not too late to address the 'Great Quartet' and slow the progression of complications.

Vascular control: Patients with impalpable

pulses need to be assessed with a Doppler and the pressure index should be quantified. If the arteries are calcified, then transcutaneous oxymetry is useful for quantifying the severity of ischaemia. Patients with a very low, or falling pressure index, need vascular referral, as do patients with severe claudication or rest pain. However, concurrent neuropathy will often prevent patients from feeling these. Very occasionally, stage 2 patients will become critically ischaemic and need referral for angiography, angioplasty or bypass, but this is rare without ulceration.

Wound and microbiological control are not relevant, because there is no ulcer at stage 2. Many stage 2 patients will need to attend a podiatrist for regular preventive footcare, and all will need regular review.

Stage 3

The ulcerated foot. Any break in the skin of a neuropathic or neuroischaemic foot, even if it appears superficial and trivial, must be taken very seriously. All ulcers are different, but certain general principles of care apply. The neuropathic foot is a 'forgiving' foot, but in the neuroischaemic stage 3 foot there is little leeway for error.

Management of the stage 3 foot

Mechanical control: Effective mechanical control is essential for all ulcers and involves the off-loading of pressure. There are a number of techniques for achieving this in the neuropathic foot, from specially designed insoles accommodated in bespoke shoes, and crutches, through to Scotchcast boots, total contact plaster casts, Aircast, wheel chairs and bed rest. Patients with ischaemic ulceration need deep, wide-fitting shoes or Scotchcast boots to prevent pressure on their marginated ulcers. Techniques chosen will depend on local availability and expertise and the duration of the ulcer: if the ulcer is not healing well within six weeks of onset, then very aggressive treatment to ensure offloading should be initiated.

Microbiological control: It is essential to prevent infection at all costs. Aseptic techniques, covering the wound with sterile dressings (changed frequently), and using microbiology to monitor the wound are important aspects of caring for the stage



Figure 1. In stage 1 we promote the prevention of complications.



Figure 2. In stage 2, the emphasis is on ulcer prevention.



Figure 3. In stage 3, the ulcer is treated.

3 ulcerated foot. Wound inspection can often detect the early signs of infection which include change in the colour of the ulcer bed, enlargement of the lesion, increased discharge and surrounding redness and swelling.

Metabolic control: Good control of diabetes is essential if rapid healing of the ulcer is to be achieved, and many patients will need review by the diabetes specialist nurse. Smokers should refrain and may need referral to a smoking cessation clinic.

Vascular control: Ischaemic ulcers which are not healing well within six weeks of onset should be referred to the vascular team. Some patients will benefit from angioplasty.

Wound control: Neuropathic ulcers will benefit from regular sharp debridement to remove all callus and slough from within and around the ulcer. Removal of undermined edges, and taking the ulcer bed back to healthy bleeding tissue can speed healing.

Ulcers may be explored with a sterile probe to ascertain their true dimensions. In the neuroischaemic foot, any removal of slough must be done with great care to avoid any injury to surrounding ischaemic tissues. All ulcers should be cleansed with saline and inspected regularly (daily if possible) so that deterioration can be detected early.

Educational control: Patients must understand that diabetic foot ulceration is a serious problem and that lack of pain does not mean that the ulcer can be ignored or neglected. Key aspects of education for the stage 3 patient include the danger signs of deterioration and what to do and where to go if this occurs. Some patients want to be taught how to dress the ulcer themselves, while in other cases, the family or community staff will need to be involved.

Stage 4

The cellulitic foot. Infection can delay healing and is a great destroyer of tissue once it takes hold. The obvious signs of infection (redness, swelling, pain and loss of function) are often diminished in the immuno-compromised diabetic patient, so good control is essential.

Management of the stage 4 foot

Mechanical control: Patients with cellulitic feet should be on total bed rest, either at home or in hospital. With every step

infection can spread, pumped along the fascial planes by the forces of walking and weight-bearing.

Microbiological control: The causative organism must be identified as soon as possible, so swabs, pus and tissue should be sent to the microbiologists without delay and the results reviewed as soon as they are available. In the meantime, broad-spectrum antibiotics should be prescribed. It is a dangerous fallacy to assume that ischaemic feet have insufficient blood flow to deliver antibiotics. If the patient has pyrexia or hyperglycaemia these should be carefully monitored as valuable indicators of whether treatment is controlling the infection.

Depending on the extent of the infection, oral, intramuscular or intravenous antibiotics may be prescribed. If the foot is painful, or fluctuant, or X-ray reveals osteomyelitis or gas in the tissues, then surgical intervention may be needed to drain and debride the foot before infection can be controlled.

Metabolic control: Infection may result in hyperglycaemia or ketosis, and the physician and diabetes specialist nurse should review the patient. Hypertension, hyperlipidaemia and smoking also need to be addressed.

Vascular control: Infection spreads with alarming rapidity in the neuroischaemic foot. Patients who require extensive surgical debridement will also need vascular intervention to improve perfusion to the foot and thus ensure that healing is achieved.

Wound control: Infected diabetic feet should be carefully debrided. In neuropathic feet the debridement can be aggressive, with removal of all sloughy, infected tissue and drainage of pus, but in the ischaemic foot, damage to the surrounding tissues must be avoided. Debridings can be sent to the microbiologists for microscopy and culture. Limited debridements can be performed by the podiatrist in the foot clinic, but more extensive drainage and debridement procedures need to be performed in theatre by the surgeons.

In the neuroischaemic foot, the vascular surgeon, who will also endeavour to improve perfusion of the foot if possible, should perform debridement.

Educational control: Patients need to understand the importance of resting the cellulitic foot and not walking. They and



Figure 4. At stage 4 the infection must be controlled.



Figure 5. At stage 5 the emphasis is on controlling the spread of gangrene, removing gangrenous tissue, and achieving full healing.



Figure 6. At stage 6, following the inevitable major amputation, the wound on the stump must be healed, the remaining foot staged and managed appropriately, and the patient rehabilitated.

their families and carers need to know the danger signs of spreading infection and the need for rapid return to clinic if this occurs.

Stage 5

This is the necrotic foot. Necrosis has supervened, usually after an ulcer has developed uncontrolled infection. However, if a major artery suddenly occludes, necrosis can develop without previous ulceration. Furthermore, diabetic renal patients have a great propensity to develop necrotic lesions.

In the neuropathic foot, infection is usually the cause of necrosis, which is wet, and associated with sloughy, infected areas. In the neuroischaemic foot, infection is still the most common reason for tissue death although ischaemia contributes. Infected gangrene is wet; ischaemic gangrene in the absence of infection is dry.

Management of the Stage 5 foot

Mechanical control: Initially, patients who develop necrosis should be admitted to hospital and put on bed rest. They will need heel protectors and regular turning to prevent decubitus ulcers. Patients who undergo surgery for wet gangrene will need a post-surgical shoe when they become mobile. Patients who receive conservative management for dry gangrene in the ischaemic foot need extra depth, wide-fitting shoes or Scotchcast boots. All stage 5 patients should limit their walking as much as possible until healing is achieved and should be reviewed by an orthotist.

Microbiological control: Wet necrosis in the neuropathic or neuroischaemic foot needs urgent intravenous antibiotics. Patients with dry necrosis will also often need antibiotics to prevent infection. Swabs and tissue samples should be regularly reviewed by the microbiologists and necrotic feet should be inspected every day to detect deterioration early.

Metabolic control: This can be difficult to achieve, as many patients will be unstable. An intensive subcutaneous insulin regime may be needed or, in severe cases, an intravenous insulin sliding scale. Cardiac and renal function should be optimised.

Vascular control: This involves angiography and angioplasty or distal bypass. If necrosis is very extensive then bypass will often be

the only hope of saving the foot.

Wound control: Wet necrosis in the neuropathic foot needs surgical debridement by the surgeon, then regular debridement of the wound edges, to encourage healing. Dry necrosis in the neuroischaemic foot, where vascular intervention is not feasible, should be managed conservatively. Excessive slough or necrotic debris should be very gently debrided away without damaging surrounding tissue. Thin dressings should be placed between the toes to separate necrotic areas from healthy areas. The demarcation line between gangrene and viable tissue should be gently debrided to remove built-up debris and wet necrosis. After a distal bypass, the patient will have leg wounds, which should be kept clean and covered with sterile dressings and regularly observed for signs of infection, which could rapidly destroy the underlying graft. Patients with painful wounds will need liberal analgesia.

Educational control: Stage 5 patients should be told that the problem is very serious. They and their families must understand the need to report any deterioration quickly. They should be advised to refrain from bathing or showering unless the foot is protected by a waterproof cover because of the risk of superimposed infection if the necrosis becomes wet.

Stage 6

The foot cannot be saved and will need a major amputation. This stage is reached when the foot is destroyed by infection, an area of full-thickness necrosis continues to extend until the foot is unsalvageable, or rest pain is agonising and cannot be controlled with analgesia.

Management of the stage 6 foot

Mechanical control: The remaining foot is at great risk of decubitus ulceration, which must be prevented at all costs with a special mattress, foam wedges and regular turning. A suitable shoe should be provided by the orthotist for the remaining foot when remobilisation and rehabilitation begin because major amputees are prone to foot problems and bilateral amputations are alarmingly frequent.

Microbiological control: Swabs from the

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Control is the key:

- 1 Mechanical control.
- 2 Microbiological control.
- 3 Metabolic control.
- 4 Vascular control.
- 5 Wound control.
- 6 Educational control.

PAGE POINTS

- 1 The Simple Staging System is simple and easy to learn.
- 2 It has good consensus between individuals.
- 3 It has been tested in a busy multidisciplinary diabetic foot clinic.
- 4 It is backed by a practical and detailed programme of care.

stump wound should be sent for microscopy and culture and a careful watch kept for signs of infection.

Metabolic control: Diabetic control peri-operatively should be achieved by intravenous insulin sliding scale and an epidural infusion should be set up two days prior to amputation.

Vascular control: Before amputation, vascular tests should be undertaken to ensure that the correct level of amputation is chosen and the patient does not end up with an ischaemic wound on an ischaemic stump.

Wound control: Neuropathic stumps are prone to develop callus on pressure points, which may need regular debridement. Surgical wounds should be kept clean and dressed until complete healing is achieved and regular inspections are important to detect deterioration early.

Educational control: The patient is now among the most high risk of all diabetic patients and needs careful education in the care of the remaining foot appropriate to whatever stage that foot is at.

Conclusion

Every diabetic patient can be placed into one of the six stages of the Simple Staging System and appropriate management for

the stage can then be planned.

We have been testing the system at King's over the past year. Initially, we explained the staging system to different healthcare professionals with differing levels of knowledge about the diabetic foot and asked them to apply it to selected groups of patients to ensure that there was good consensus between individuals as to which stage should be applied. This proved to be the case, and we now use the system as a basis for the diabetic foot care we offer. ■

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The authors would welcome any comments from readers about the Simple Staging System. Please write to The Diabetic Foot journal, 15 Mandeville Courtyard, 142 Battersea Park Road, LONDON SW11 4NB, or via the website: www.diabeticfootjournal.com

Footpressure Interest Group Bulletin

Sue Barnett (University of the West of England, Bristol) on behalf of the Footpressure Interest Group

The next International Footpressure Interest Group (FIG) conference will be held during 2001. To make the meeting topical and relevant to current practice, we invite your feedback – some suggested subjects to cover are:

- 1) Enormous developments have been made in the plantar pressure measuring industry. Manufacturers could showcase their products, with 'hands-on' workshops.
- 2) How is plantar pressure measurement being used? Increasingly, this science is providing evidence to support clinical practice and justify therapeutic interventions. The meeting could update people on recent findings and novel utilisation.
- 3) Recent technical advances now allow us to synchronise and integrate data from various systems. Therefore, plantar pressure distribution information does not have to be measured in isolation. Information on 3-D ground reaction forces, video analysis, 3-D gait analysis, muscle activity, etc, can be obtained at the same time. What additional

information does this give us, and how will it change patient management? Which parameter is the most important to measure, or is the parameter measured dependent on the type of patient or the question being asked? At the moment, there are no protocols in common use for the acquisition, interpretation and presentation of data obtained in this way – should the conference aim to start the process of producing such international guidelines?

Also, please tell us when and where the meeting should be held. Is May, the traditional month, convenient? Weekends or weekdays? Southern England has been suggested for parity of access, hence we have been considering London, Birmingham or Bristol – each offers the road, rail, and air infrastructure needed for international delegates. Do these venues appeal?

Contact Sue Barnett with your opinions/suggestions at Room 1E13, Faculty of Health and Social Care, University of the West of England, Glenside Campus, Blackberry Hill, Stapleton, Bristol, BS16 1DD, UK.
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