mortality rates *higher* than those of prostate cancer, breast cancer or Hodgkin's disease. If you include those presenting with ischemic foot ulcerations, their five year mortality is greater than that with the above cancers plus colon cancer. Of course, the patients are not dying specifically from the ulceration. Rather, the ulceration is a marker for the other systemic manifestations found in patients with diabetes. This is a new, unconventional and powerful way to look at diabetic foot ulcerations and, as the authors point out, should change how we discuss them with all interested parties including patients, healthcare policy makers and ourselves.

ULCERATIONS AND INFECTIONS

The Diabetic Foot Infections Guidelines Committee of the Infectious Diseases Society of America published their original, evidence based guidelines in 2004. The diabetic foot infection classification system spelled out in this document has now been independently validated and the entire document, along with a very similar work published by the International Working Group on the Diabetic Foot (IWGDF), has been widely accepted in the diabetic foot community. The IDSA document is in the public domain and is available on-line from the IDSA website at www.idsociety.org. It is highly recommended reading for any practitioner involved in the management of diabetic foot infections. An updated document is expected to be completed by early 2010 and will also be available on the Society's Web site. Although the actual infection classification will remain the same, all other aspects of the guidelines will be revised to reflect the latest published evidence and expert opinion in the field.

For ease of reference the Executive Summary points of the Guidelines are reproduced here:

1. Foot infections in patients with diabetes cause substantial morbidity and frequent visits to health care professionals and may lead to amputation of a lower extremity.
2. Diabetic foot infections require attention to local (foot) and systemic (metabolic) issues and coordinated management, preferably by a multidisciplinary foot care team. The team managing these infections should include, or have ready access to, an infectious diseases specialist or a medical microbiologist
3. The major predisposing factor to these infections is foot ulceration, which is usually related to peripheral neuropathy. Peripheral vascular disease and various immunological disturbances play a secondary role.

4. Aerobic Gram-positive cocci (especially *Staphylococcus aureus*) are the predominant pathogens in diabetic foot infections. Patients who have chronic wounds or who have recently received antibiotic therapy may also be infected with Gram-negative rods, and those with foot ischemia or gangrene may have obligate anaerobic pathogens.
5. Wound infections must be diagnosed clinically on the basis of local (and occasionally systemic) signs and symptoms of inflammation. Laboratory (including microbiological) investigations are of limited use for diagnosing infection, except in cases of osteomyelitis.
6. Send appropriately obtained specimens for culture prior to starting empirical antibiotic therapy in all cases of infection, except perhaps those that are mild and previously untreated. Tissue specimens obtained by biopsy, ulcer curettage, or aspiration are preferable to wound swab specimens.
7. Imaging studies may help diagnose or better define deep, soft-tissue purulent collections and are usually needed to detect pathological findings in bone. Plain radiography may be adequate in many cases, but MRI (in preference to isotope scanning) is more sensitive and specific, especially for detection of soft-tissue lesions.
8. Infections should be categorized by their severity on the basis of readily assessable clinical and laboratory features. Most important among these are the specific tissues involved, the adequacy of arterial perfusion, and the presence of systemic toxicity or metabolic instability. Categorization helps determine the degree of risk to the patient and the limb and, thus, the urgency and venue of management.
9. Available evidence does not support treating clinically uninfected ulcers with antibiotic therapy. Antibiotic therapy is necessary for virtually all infected wounds, but it is often insufficient without appropriate wound care.
10. Select an empirical antibiotic regimen on the basis of the severity of the infection and the likely etiologic agent(s). Therapy aimed solely at aerobic Gram-positive cocci may be sufficient for mild-to-moderate infections in patients who have not recently received antibiotic therapy. Broad spectrum empirical therapy is not routinely required but is indicated for severe infections, pending culture results and antibiotic susceptibility data. Take into consideration any recent antibiotic therapy and local antibiotic susceptibility data, especially the prevalence of methicillin-resistant *S. aureus* (MRSA) or other resistant organisms.

Definitive therapy should be based on both the culture results and susceptibility data and the clinical response to the empirical regimen.

11. There is only limited evidence with which to make informed choices among the various topical, oral, and parenteral antibiotic agents. Virtually all severe and some moderate infections require parenteral therapy, at least initially. Highly bioavailable oral antibiotics can be used in most mild and in many moderate infections, including some cases of osteomyelitis. Topical therapy may be used for some mild superficial infections.
12. Continue antibiotic therapy until there is evidence that the infection has resolved but not necessarily until a wound has healed. Suggestions for the duration of antibiotic therapy are as follows: for mild infections, one to two weeks usually suffices, but some require an additional one to two weeks; for moderate and severe infections, usually two to four weeks is sufficient, depending on the structures involved, the adequacy of debridement, the type of soft-tissue wound cover, and wound vascularity; and for osteomyelitis, generally at least four to six weeks is required, but a shorter duration is sufficient if the entire infected bone is removed, and probably a longer duration is needed if infected bone remains.
13. If an infection in a clinically stable patient fails to respond to one or more antibiotic courses, consider discontinuing all antimicrobials and, after a few days, obtaining optimal culture specimens.
14. Seek surgical consultation and, when needed, intervention for infections accompanied by a deep abscess, extensive bone or joint involvement, crepitus, substantial necrosis or gangrene, or necrotizing fasciitis. Evaluating the limb's arterial supply and revascularizing when indicated are particularly important. Surgeons with experience and interest in the field should be recruited by the foot care team, if possible.
15. Providing optimal wound care, in addition to appropriate antibiotic treatment of the infection, is crucial for healing. This includes proper wound cleansing, debridement of any callus and necrotic tissue, and, especially, off-loading of pressure. There is insufficient evidence to recommend use of a specific wound dressing or any type of wound healing agents or products for infected foot wounds.
16. Patients with infected wounds require early and careful follow-up observation to ensure that the selected medical and surgical treatment regimens have been appropriate and effective.

17. Studies have not adequately defined the role of most adjunctive therapies for diabetic foot infections, but systematic reviews suggest that granulocyte colony-stimulating factors and systemic hyperbaric oxygen therapy may help prevent amputations. These treatments may be useful for severe infections or for those that have not adequately responded to therapy, despite correcting for all amenable local and systemic adverse factors.
18. Spread of infection to bone (osteitis or osteomyelitis) may be difficult to distinguish from noninfectious arthropathy. Clinical examination and imaging tests may suffice, but bone biopsy is valuable for establishing the diagnosis of osteomyelitis, for defining the pathogenic organism(s), and for determining the antibiotic susceptibilities of such organisms.
19. Although this field has matured, further research is much needed. The committee especially recommends that adequately powered prospective studies be undertaken to elucidate and validate systems for classifying infection, diagnosing osteomyelitis, defining optimal antibiotic regimens in various situations, and clarifying the role of surgery in treating osteomyelitis.

ULCERATIONS

Since ulceration is the leading risk factor for infection in patients with diabetes, they warrant their own section.

Classification

Depth and Severity Classification

Many attempts have been made to classify ulcerations in patients with diabetes. Classification allows all clinicians to similarly describe, document and treat these patients. Furthermore, classification allows facilitation of communications between treating practitioner and clinical investigators. It puts everybody on the "same page" so to speak. Unfortunately, despite the recognized desire to accept one universal system, this has not been accomplished. Since the mid 1970s, the Wagner system has been the most commonly utilized. This system consisting of six "grades" of ulcers, primarily describing the depth of the lesion (grades 0-4) or the extent of tissue destruction (grades 5-6). The primary drawback to this system is that co-morbidities such as infection or ischemia are not included. In fact, infection is not even considered an issue until a Wagner Grade III. Why couldn't there be an infection present in a grade I or II? This is never addressed. Also, the title of the original paper was "The dysvascular foot…"

Since diabetic foot ulcerations tend to occur in neuropathic, and not necessarily ischemic feet, this system is of limited utility and should be supplanted by others. The University of Texas at San Antonio has proposed a system that has since been clinically validated. It simplifies Wagner and includes the aforementioned co-morbidities (Table 5-1).

Regardless of which system an individual clinician utilizes some general suggestions apply:

1. The use of a classification system is not required. However, it may be helpful especially in a group practice where more than one practitioner may see the patient.

TABLE 5-1

Utsa Classification

GRADE 0	**No open lesions; may have deformity** A. without infection or ischemia B. with infection C. with schemia D. with infection + ischemia
GRADE 1	**Superficial Wound not involving tendon, capsule or bone** A. without infection or ischemia B. with infection C. with ischemia D. with infection + ischemia
GRADE 2	**Wound Penetrating to tendon or capsule** A. without infection or ischemia B. with infection C. with ischemia D. with infection + ischemia
GRADE 3	**Wound Penetrating to bone or joint** A. without infection or ischemia B. with infection C. with ischemia D. with infection + ischemia

Adapted from Armstong DG, et al. Diabetes Care, 1998

2. If a system is to be used in documentation, it is important to detail *which* system is being employed. For instance; "The patient presents with a Wagner grade 1" or, "The patient presents with a UT grade 2C." Just documenting that "the patient has a grade 2 ulceration" can leave the note open to interpretation.
3. Note the size of the individual lesion preferably in at least two dimensions if feasible. Three may be ideal, but is seldom done.

Infection Classification

Although the systems based on depth and severity may pay lip service to the presence or absence of infection, there was a need for an ulcer classification that *specifically* looked at whether the ulceration was infected or not, if so how badly, what organism is causing the infection and what would be the best antibiotic selection. Having been primarily designed by specialists in infectious diseases, the IDSA diabetic foot infection classification (or the IWGDF PEDIS system), addresses those questions (Table 5-2).

The IDSA classifies ulcerations into four categories.

1. Non-infected ulcerations
2. Mild Infections
3. Moderate infections
4. Severe infections.

Non-infected Mal Perforans Ulcerations

Probably the most important question is, what constitutes an infected ulceration versus one that is merely contaminated with bacteria? The ubiquitous swab culture of any ulcer will most likely grow bacteria. Ulcers are perfect media to support bacterial growth. Does this positive culture mean that there is an infection? Do antibiotics have to be prescribed? Most assuredly the answer is *NO*. Only when there are clinical signs and symptoms of an infection in conjunction with the ulceration is therapy needed.

There are some general rules of thumb, many of which have already been discussed in Chapter 1 but bear restating when dealing specifically with ulcers:

1. Cultures do not diagnose infection; they allow determination of what organism is causing the infection that has been clinically diagnosed.
2. An ulceration need not be cultured unless there are clinical signs and symptoms of infection.
3. A positive culture is not diagnostic of infection.

TABLE 5-2

Clinical classification of a diabetic foot infection

Clinical Manifestations of infection	Infection severity	PEDIS grade[a]
Wound lacking purulence or any manifestations of inflammation	Uninfected	1
Presence of ≥2 manifestations of inflammation (purulence, or erythema, pain, tenderness, warmth, or induration), but any cellulitis/erythema extends ≤2 cm around the ulcer, and infection is limited to the skin or superficial subcutaneous tissues; no other local complications or systemic illness.	Mild	2
Infection (as above) in a patient who is systemically well and metabolically stable but which has ≥ 1 of the following characteristics: cellulitis extending >2 cm, lymphangitic streaking, spread beneath the superficial fascia, deep-tissue abscess, gangrene, and involvement of muscle, tendon, joint or bone.	Moderate	3
Infection in a patient with systemic toxicity or metabolic instability (e.g., fever, chills, tachycardia, hypotension, confusion, vomiting, leukocytosis, acidosis, severe hyperglycemia, or azotemia).	Severe	4

Note: International Consensus on the Diabetic Foot PEDIS system: perfusion, extent/size, depth/tissue loss, infection, and sensation.