

DECISION MAKING IN DIABETIC FOOT INFECTIONS

Kieran T. Mahan, M.S., D.P.M., F.A.C.F.S.

There are a number of different areas that can be discussed when dealing with diabetic foot infections. Indeed, this has become a very popular, though sometimes controversial, topic. The focus of this paper will be on decision making in diabetic foot infections.

The initial evaluation in managing diabetic foot infections is to determine both the presence and seriousness of the infection. The significance of this decision is much more important in diabetics than in most other individuals, due to the immune compromise, macrovascular disease, or microvascular disease that is often present. In particular, the failure to diagnose a central plantar space infection can result in rapid progression of the infection with resultant high level amputation. Further complicating this decision, is the fact that many serious infections in diabetic patients begin with very minor trauma to the digits. For example, medial and lateral plantar space infections often result from trauma and abscesses around the nails. Central plantar space infections carry the greatest risk because of the possibility of occlusion of the plantar arterial arch with resultant gangrene to the forefoot. These central plantar space infections often result from minimal abrasions to the interdigital spaces. All of the above make it clear why daily observation by the patient or his family is important in the diabetic foot. This also makes it clear why the digital area (in both feet) must be carefully inspected every time a diabetic presents to the office for evaluation or treatment.

When infection has been recognized, a series of factors must be evaluated in order to determine whether the infection should be managed on an in-patient or out-patient basis. These factors include the results of the detailed physical examination, important factors being vital signs, vascular evaluation, the presence of popliteal or inguinal nodes. These factors also include the presence of infection in one of the plantar spaces. Some of the criteria for in-patient management of a diabetic foot would include the following:

1. Signs of systemic infection including presence of enlarged lymph nodes, fever, or constitutional symptoms such as malaise, disorientation, etc.
2. Poor metabolic control in the face of an infection.
3. Evidence of vascular compromise insufficient to adequately fight the infection.

4. Evidence of the infection advancing along any fascial plane.
5. Interdigital infections with evidence of penetration into the plantar spaces.

The above criteria are general guidelines. Many times, diabetic foot infections are polymicrobial and often have significant odor and edema associated with them. These readily evident physical signs may make the decision to hospitalize easier. However, especially in the immunocompromised patient, many of these physical signs will be lacking. In the face of minimal local signs, but significant other systemic irregularities (severe hyperglycemia or hypoglycemia, temperature elevation, cardiac arrhythmia or malaise) the patient should be hospitalized.

When an infection is being managed on an out-patient basis, several factors are important in ensuring the success of therapy. These include:

1. Ensuring that metabolic control is being maintained by the primary physician.
2. An appropriate culture and sensitivity is performed in order to allow definitive antimicrobial therapy.
3. Local incision and drainage is performed where necessary.
4. The patient has adequate circulation to both resist local infection and facilitate penetration of antimicrobial agents.

SURGICAL INCISION AND DRAINAGE

Upon admission to the hospital, a thorough medical evaluation should be performed. In addition, any borderline patients should be evaluated for vascular patency. In general, incision and drainage should be performed immediately. Frequently, the incision and drainage immediately improves the medical condition of an unstable patient. Nonetheless, the anesthesiologist needs to be closely consulted in order to ensure that the anesthesia will not pose a significant risk to the patient. The other important decision in the timing of the surgical incision and drainage revolves around vascular patency. In general, surgical incision and drainage should be delayed until re-vascularization can be

performed. In the case of large abscess formations, the abscess can be relieved through a minimal incision and drainage technique in order to prevent vascular compromise to the local tissues. However, a definitive surgical incision and drainage, and/or local amputations should not be performed until the necessary re-vascularization has been accomplished.

The technique for incision and drainage involves careful incision planning where possible in order to prevent further local tissue compromise. Also, one strives to achieve the dual goals of complete exposure to the infected area and protecting the appropriate tissue for later closure. The important aspects of surgical incision and drainage in the diabetic patient are to:

1. Have adequate exposure to all areas and ensure that the incision completely exposes infected tissues,
2. Ensure that aggressive debridement is carried out at the time of the incision and drainage.

In some patients, local signs may be minimal, and it may be difficult to identify all areas of abscess formation. It is better to err on the side of unnecessarily exposing healthy tissue than missing an abscessed area. In addition, the patient should be carefully monitored after the initial incision and drainage to ensure that improvement is rapid. Any failure of the wound to improve rapidly may be a sign that there is still residual infection present. This would necessitate a return trip to the operating room.

Another decision at the time of surgical incision and drainage is the extent of amputation that should be performed at the time of the initial procedure. The author's preference is to err on the side of tissue preservation at the time of the initial incision and drainage. This extends even to the point of leaving dry unhealthy toes in place, if it is believed that the skin and tissue overlying those toes can be harvested to assist in wound coverage at a later date. Once the infection begins to resolve, the decision about which tissues are to be amputated may become more difficult. The process of frequent return trips to the OR in order to debride ever increasing levels of tissue has sometimes been called "whittling". There clearly comes a point at which the patient's best interest is served by a definitive surgical procedure. This involves both careful evaluation of vascular data and careful evaluation of function. Vascular data may include cutaneous flourecein photoelectric plethysmography, impedance plethysmography, arteriograms (including subtraction angiography) ankle-arm index, etc. The evaluation of the vascular status is of course the primary determinant. However, a secondary consideration is the functional status of the foot. The goal of any surgical treatment of the diabetic foot infection should be to ensure that the patient has a stable foot that can be housed in a shoe with minimal risk of

irritation or excessive pressures. Procedures such as individual metatarsal amputations may create additional or even greater problems in some of these patients.

POST SURGICAL MANAGEMENT

Following incision and drainage, wound management techniques are initially directed towards the removal of any residual bacteria or necrotic material. This means that the techniques will consist of frequent dressing changes, wound lavage with anti-microbial agents, and local wound debridement. It is critical that all this be performed using strict sterile technique. Patients should also be carefully re-evaluated for the possibility of a re-operation. This may be necessary if the condition of local tissues fails to improve, or with continued systemic signs of infection. Re-operation may also be necessary for local wound necrosis or in order to achieve a more functional part as indicated above.

Wound closure is usually delayed until the wound is clinically clean and granulating well. Good granulation tissue can be promoted by less aggressive wound management techniques. Once the wound appears clean we generally will reduce the number of dressing changes, use gentle saline lavage, and will begin using a variety of synthetic dressing materials that promote granulation and epithelialization. In general, three (3) negative cultures are nice to have. However, given the possibility of continued wound contamination, it is not always necessary. Wound closure may be performed as a delayed primary closure with suture or via a variety of other wound closure techniques. Delayed primary closures are the most simple and direct means of closure, but may place the greatest strain on local tissues. For delayed primary closure, the skin is generally sutured with non-absorbable simple interrupted sutures. Bolster sutures may also be necessary for a few days in order to keep tension off the wound margins. Deep closure is generally accomplished with an absorbable monofilament type of suture. Other types of wound closure can also be utilized including muscle flaps with overlying skin grafts, intermediate split thickness skin grafts over a good granulation tissue base, and a variety of other local and distant flap techniques.

POSTOPERATIVE OFFICE MANAGEMENT

Following significant surgery in the diabetic foot, it is critical to monitor the transition back to shoe gear. Control of edema, and promotion of good foot hygiene are mandatory. In addition, a variety of shoe modifications may be necessary in order to accommodate the foot after surgery. A variety of temporary devices can be utilized such as urethane molds, particularly when digital amputations have been performed.

IS SALVAGE WORTH THE EFFORT?

In order to obtain an effective salvage in the foot, there is frequently a need for very extensive and concentrated care by the surgeon and a team of other specialists. Somewhere between the "whittling" technique and aggressive immediate below or above the knee amputations, lies a gray area that requires a surgeon's wisdom and judgement. Clearly, there are many advantages to preserving the significant segment of the foot. These include the ease of rehabilitation, the ability of the patient to maintain greater mobility with less oxygen consumption, reduced need for gait assisting devices, as well as the psychological benefit of the retention of the limb. Another critical element is that frequently diabetics with one foot problem end up with another foot problem on the contralateral limb. Problems with the opposite extremity are further increased once a major limb amputation is performed. Efforts should certainly be directed to preserving the foot whenever possible.

There are of course disadvantages to distal amputations and these are primarily the risk of initial failure. This failure may require multiple re-operations and may, in fact, prolong the patient's initial hospital stay when compared to an earlier more definitive amputation. These decisions are of course difficult and should be made in conjunction with the patient, his family, and other members of the medical team. Coordination of all of these efforts should be focused on preserving the patient's quality of life.

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