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Limb Salvage: It’s a Philosophy

Amputation prevention requires patience, planning, and persistence.

By Lee C. Rogers, DPM

The Mental Game

The World Health Organization and the International Diabetes Federation have stated that nearly 85% of diabetes-related amputations are preventable. While it requires a necessary technical skill set to perform complex interventions to save the diabetic foot from amputation, limb salvage is largely a “mental game.” The mental game is understanding and intervening in the patho-physiology, how to improve the patho-mechanics, and a good dose of patience. The natural history of how a patient with diabetes requires an amputation is fairly well understood. We have described the concept “Stairway to an Amputation” which easily outlines this natural history (Figure 1).

We first categorize a patient on one of the stair steps and decide what interventions can be done in order to prevent them from moving to a higher step, and ultimately what can be done to de-escalate the patient to a lower step. For example, in the case of someone on step 3 with an ulcer, if you can prevent that ulcer from becoming infected (step 5), or if you can treat the vascular disease (step 4), the amputation can be prevented. Moreover, if one can achieve ulcer healing, then the patient can de-escalate to step 2.

This concept fits nicely with the six-component program that we described in JAPMA in Mar/Apr 2010 in our article “Organized programs to prevent lower-extremity amputations.” We implemented this program which concentrated on 1) infection management, 2) vascular disease recognition and management, 3) off-loading plantar pressure, 4) debridement of wounds, 5) promotion of granulation tissue, and 6) wound closure. We were able to reduce major limb losses by 72% in one year and achieved a high-low amputation ratio of 0.05.

The high-low amputation ratio was described by Wrobel and Armstrong and is calculated by taking the number of high-level amputations (AKA and BKA) divided by the number of low-level amputations (partial foot or limb-sparing).

The vast majority of amputations are a result of infection, gangrene, or a non-healing wound.

In order to prevent diabetes-related amputations, one must first know what causes them. Pecoraro, et al. in 1990 published just that. The vast majority of amputations are a result of infection, gangrene, or a non-healing wound.

Infection

As illustrated in our Stairway model, infection is almost always the coup de grace that leads to the amputation. It needs to be dealt with swiftly to save both limb and life. Infections can be classified as limb-threatening or non-limb-threatening based on the extent, but a more exact classification of diabetic foot infections (DFI) was put forth by the Infectious Diseases Society of America (IDSA). The IDSA classifies DFI into uninfected, mild, moderate, or severe infections. Mild infections have less than 2 cm of surrounding cellulitis without deep spread to bone or tendon and no systemic signs. They are non-limb-threatening and can be treated as an outpatient. Moderate and severe infections have greater than 2 cm of surrounding cellulitis, can have deep spread to bone or tendon, and in the case of severe infections, systemic instability. Moderate and severe infections are generally treated as an inpatient and are limb-threatening.

Resistance in diabetic foot infections is common and needs to be considered. There are newer drugs for MRSA, and several more currently are undergoing trials. In limb—and life-threatening infections, anti-MRSA therapy should be started first, in a de-escalation fashion. After the culture and sensitivity is reported, the spectrum of coverage can be narrowed.

Many times DFI are surgical emergencies. Gas in the tissue or an abscess requires urgent surgical management. Open amputations should be limited to only infected or necrotic tissue and should leave any viable tissue, without regard to functionality. The function of the foot can be addressed in a second-stage surgery, and one might require all the soft tissue possible for closure.

Gangrene

While gangrene is an irreversible loss of tissue, revasculariza-
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t can limit the amount of peri-
gangrenous tissue lost. Critical
limb ischemia is reversible with
good vascular care. There are a
multitude of vascular procedures
ranging from endovascular to open
bypass, but the fact remains
that the diabetic foot requires max-
imum perfusion to heal. Care must
be taken when interpreting non-
 invasive studies as some are influ-
enced by calcification, inflamma-
tion, or infection. If the foot is
clinically ischemic, it requires
an intervention.

If the foot is infected,
surgery is performed first to
treat the infection. How-
ever, there is no good
answer on the timing of
foot reconstruction
after revascularization.
Some surgeons co-
operate with vascular
surgeons and per-
form the reconstruc-
tion in a single stage.
Others wait a few
days to weeks after
revascularization.

Non-healing
Wound

The non-healing wound tends
to be a “catch all” phrase for any
wound that is failing any therapy.
Most wounds will respond to some
sort of therapy, so if a wound isn’t
healing, it should cause the clinici-
an to alter the treatment strategy.
If one’s wound-healing “toolbox”
is small, there will be more non-heal-
ing wounds than if a clinician is
familiar with more treatments. We
approach wounds from a surgical
perspective. They respond well to
wide surgical debridement, promo-
tion of granulation tissue with
Wound VAC®, and then closure
with a variety of modalities such as
Dermagraft® (Advanced Biohealing),
split thickness skin grafts, flaps,
and DermaClose® (Wound Care
Technologies).

Most diabetic foot wounds are
caused by abnormal pressure. The
pathomechanics of the foot need to
be addressed. During wound heal-
ing, we often use removable cast
walkers rendered irremovable,
referred to as the instant total contact
_cast (ITCC). But one must not for-
get about intrinsic or surgical off-
loading. A good example is that of
a Keller arthroplasty for a distal hal-
lix ulcer. The hallux is the most
common location for a diabetic
foot ulcer, and many distal hallux
ulcers are caused by hallux limitus
in the face of neuropathy.

A Keller arthroplasty improves

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