

Diabetic Limb Preservation: Defining Terms and Goals



Editor's note: Although many of us undertake, on an almost daily basis, surgical procedures that are directed at limb salvage, it is interesting to consider that the definition of limb salvage may vary from surgeon to surgeon and, more importantly, from patient to patient. As a general rule, I think that most foot and ankle surgeons focus their efforts on optimizing patient function while trying to maximize tissue preservation. In the following commentary, Dr. Andersen addresses the concept of limb salvage and offers his view of 'functional limb preservation.

The definition of "diabetic limb preservation" is a general one that is used for initiatives aimed at preventing amputations in patients with diabetes. Key to this approach is defining what constitutes a limb and what constitutes an amputation. What are "limb-preserving" or "limb-sparing" amputations? Initially, when limb-preservation clinics were started, any amputation, including isolated toes, was considered a failure of the initiative. With this philosophy every toe took on a "life of its own." This led to feet with 1 or 2 attached toes that functioned poorly and inevitably developed ulcerations on the remaining toes or forefoot,

Disclaimer: The opinions or assertions contained herein are the private view of the author and are not to be construed as official or reflecting the views of the Department of the Army or the Department of Defense.

requiring chronic wound care to delay further amputation. Although the remaining toes were "saved," the foot and by default the patient was never truly functional. I have been actively involved in limb preservation since first entering the field of vascular surgery, and I have interacted closely with podiatric foot and ankle surgeons and the unique skill set they have to offer for the past 16 years. I have had the pleasure of working with podiatric surgeons and their fellows at our institution, and through many discussions we have reevaluated the terms and goals of "limb preservation." In doing so, the following are appropriate questions:

1. Are staged toe amputations better than a well-balanced transmetatarsal amputation?
2. How many toes and/or which toes do you amputate before recommending a transmetatarsal amputation?
3. Is a lower extremity without toes a "limb"?
4. If toe amputations or distal foot amputations are considered "limb-preserving" amputations, what is the best "limb-preserving" amputation?

Although I do not claim to have all the answers to these questions, I believe a better goal in "limb preservation" may be to balance tissue loss against limb function. With this focus, prophylactic surgery to correct structural deformities or a well-performed transmetatarsal amputation with balancing, as the foot and ankle surgeons and their fellows (1–12) have described, may be a better option than ongoing palliative skin care, chronic wound care, or multiple staged toe amputations, especially when the hallux is amputated or more than 2 lesser toes require amputation. Perhaps instead of "limb preservation" we should label the goal as "preservation of maximum lower limb function." Perhaps each toe should not have a "life of its own" when it comes to optimal function.

With this in mind, the goal should be to preserve maximum function in the lower limbs of patients with diabetes or, if function has been compromised, to restore function in the most expeditious manner. Defining the goal in this way, elective reconstruction of the diabetic foot and ankle becomes part of "limb preservation." Elective reconstruction performed in the appropriate patient for the correct indications may improve function and help prevent ulceration. An aggressive approach should be taken to address the underlying structural changes contributing to the ulceration, in addition to administration of appropriate wound care. This approach may decrease the number of patients requiring chronic wound care, improve function, and lower the incidence of recurrent ulceration. If an ulcer fails to heal, the most likely cause is repetitive trauma and failure to identify and correct structural abnormalities, rather than the type of wound care administered.

For the patient with a chronic wound, the focus becomes preserving or restoring maximum function as opposed to prevention of any type of amputation. Goals will vary depending on the functional abilities of individual patients. For example, in a patient who is bed bound and has a lower extremity ulceration that fails to heal, the best option may be a major amputation preserving enough length for balance and turning in bed. If this procedure is performed in a timely fashion it may save health care dollars and decrease chronic pain, suffering, and morbidity in given patients. In this setting, an elective amputation should not be

considered a failure of the initiative but the best option for this individual. In a young, active patient who is employed and has chronic recurring ulcerations involving the toes or distal metatarsal heads, a decision to proceed with a balanced transmetatarsal amputation with more rapid return to work and a durable residual foot may represent the best option. Similarly, for a patient with a Charcot neuroarthropathy deformity of the midfoot or hindfoot that has failed bracing and similar care, and who cannot adhere to the lengthy requirements necessary for a reconstruction, a primary amputation at the foot or below-knee level may be the most humane approach. Daily wound care combined with pain and limited mobility is simply not the correct long-term option. Maybe there should be a time limit on how long a diabetic foot ulcer should be properly treated before removing the ulceration and deformity with a “limb-sparing” amputation. It is well known that the longer a diabetic foot ulcer is present, the more likely it is that the patient will develop chronic osteomyelitis or present with an acute infection and require a semi-emergent or emergent major amputation. These data suggest that prolonged chronic wound care is not the best option in most patients.

With the increasing number of patients with diabetes in our population and the risk for loss of lower extremity function, it is important to have initiatives to maintain and/or restore function. This is not the same as an initiative aimed purely at preventing any type of amputation in the patient. It is very important that we define terms and goals. It is also important that the goals are patient specific. Initiatives should include early evaluation of function, as well as maintaining and/or maximizing function. This is different from initiatives aimed purely at preventing ulceration or amputation.

The new question is: how do we maintain and/or restore lower limb function in the patient with diabetes? “Functional limb preservation” may be the appropriate terminology and focus. This is the initiative that I have been working to develop with the foot

and ankle surgeons, our vascular surgery colleagues, and the multidisciplinary “team” we have here at the Madigan Army Medical Center. If our initial efforts are an indication of what lies ahead, then I know we are on the correct “functional limb preservation” initiative pathway.

*Col (Ret.) Charles A. Andersen, MD, FACS
Chief, Vascular Surgery Service Director, Wound Care Clinic
Department of Surgery Madigan Army Medical Center
Tacoma, Washington*

References

1. Roukis TS. Peroneus longus recession. *J Foot Ankle Surg* 48(3):405–407, 2009.
2. Roukis TS. Tibialis posterior recession. *J Foot Ankle Surg* 48(3):402–404, 2009.
3. Roukis TS. Flexor hallucis longus and extensor digitorum longus tendon transfers for balancing the foot following transmetatarsal amputation. *J Foot Ankle Surg* 48(3):398–401, 2009.
4. Schweinberger MH, Roukis TS. Intramedullary screw fixation for balancing of the dysvascular foot following transmetatarsal amputation. *J Foot Ankle Surg* 47(6):594–597, 2008.
5. Schweinberger MH, Roukis TS. Soft-tissue and osseous techniques to balance forefoot and midfoot amputations. *Clin Podiatr Med Surg* 25(4):623–639, 2008.
6. Öznur A, Roukis TS. Minimum incision ray resection. *Clin Podiatr Med Surg* 25(4):609–622, 2008.
7. Roukis TS, Schade VL. Minimum incision metatarsal osteotomies. *Clin Podiatr Med Surg* 25(4):587–607, 2008.
8. Schweinberger MH, Roukis TS. Surgical correction of soft-tissue ankle equinus contracture. *Clin Podiatr Med Surg* 25(4):571–585, 2008.
9. Schweinberger MH, Roukis TS. Extra-articular immobilization for protection of percutaneous tendo-Achilles lengthening following transmetatarsal amputation and peripheral arterial bypass surgery. *J Foot Ankle Surg* 47(2):169–171, 2008.
10. Schweinberger MH, Roukis TS. Salvage of the first ray with external fixation in the high-risk patient. *The Foot and Ankle Specialist* 1(4):210–213, 2008.
11. Schweinberger MH, Roukis TS. Balancing of the transmetatarsal amputation with peroneus brevis to peroneus longus tendon transfer. *J Foot Ankle Surg* 46(6):510–514, 2007.
12. Andersen CA, Roukis TS. The diabetic foot. *Surg Clin* 87(5):1149–1177, 2007.

Book Review

Surgical Reconstruction of the Diabetic Foot and Ankle

Lippincott Williams & Wilkins, Philadelphia, 2009
Edited by Thomas Zgonis, DPM, FACFAS
448 pages, illustrated, ISBN 978-0-7817-8458-0

One editor and 52 very experienced surgeons have produced this magnificent textbook on surgical techniques related to foot and ankle reconstruction of the patient with diabetes. The color photographs total more than 800 and are simply beautiful. These photographs are very informative and show, in step-by-step fashion, the individual chapter author’s surgical technique for performing the procedures currently used for surgical reconstruction of the foot and ankle in patients with diabetes.

The textbook comprises 29 individual chapters dealing essentially with every common problem related to patients with diabetes that can manifest itself in the foot and ankle and require surgical reconstruction. Each chapter is written by a single author or several authors from around the world and review of electronic search engines reveals that most authors have previously published material on the topic they have been assigned. All of the

chapters have a reference list and in the vast majority the latest references are included, which is impressive given the long delays between submission and publication of most textbooks.

The chapters flow in a uniform pattern with easy-to-follow text and gorgeous photographs and illustrations that make digestion of the specific pathology or surgical technique discussed very simple, easy, and quick to accomplish. The mere fact that most of the feet and lower limbs shown in this textbook appeared unsalvageable and yet have apparent long-term follow-up pictures demonstrating functional healed soft tissue integument and stable osseous segments is truly amazing. This textbook contains a wealth of highly specialized knowledge and is a gold mine for any surgeon specializing in reconstruction of the foot and ankle in patients with diabetes. I strongly recommend it to all surgical groups treating patients with diabetes and the untoward manifestations unleashed on these individuals’ feet and lower limbs.

*Thomas S. Roukis, DPM, PhD, FACFAS
Chief, Limb Preservation Service
Vascular/Endovascular Surgery Service
Department of Surgery
Madigan Army Medical Center
Tacoma, WA*