CHAPTER **37**

SURGICAL TECHNIQUES OF HALLUX AMPUTATION

James L. Bouchard, DPM

Many surgeons have documented the success of more distal amputations emphasizing the techniques of limb preservation. The primary function of the lower extremity is locomotion and the podiatrist's goal is to preserve this function. Because the amount of energy expended in walking increases as the level of the amputation progresses proximally, the primary objective of amputation surgery when necessary is the maintenance of a functional stump at a level capable of healing. When a neurotrophic diabetic patient presents with a chronic foot ulceration, a more proximal amputation is not always necessary. Partial forefoot amputations may allow for preservation of a functional foot with a major advantage being the ability to bear weight.

The purpose of this presentation is to present the principles and techniques of hallux amputation surgery emphasizing the intraoperative procedures and outlining the surgical techniques of both hallux disarticulation and osteotomy hallux amputations. The advantages and disadvantages of both techniques are presented. One of the major objectives of hallux amputation surgery is to maintain a functional limb, which is capable of adequate wound healing, thus preventing the need for additional amputation at a more proximal level.

GENERAL PRINCIPLES

Most surgeons agree on certain basic principles in amputation surgery in order to obtain a successful result. These may be categorized in the following anatomic groups: skin, muscle function, nerve endings, blood vessels, bony prominences, and diseased tissues. These principles are applicable to hallux amputation.

Great care must be taken by the surgeon to minimize trauma to the skin, by avoiding unnecessary instrumentation or excessive handling of the tissues. In order to preserve the deep circulation and viability of the tissues, anatomic dissection with separation of tissue layers is avoided. During surgery, consideration must be given to each tissue encountered and the role it would play in providing function following hallux amputation. It is essential that all diseased tissue is excised and that no dead space remains prior to final skin closure. It is important to determine whether the wound should be packed open, or closed by secondary healing, delayed primary closure at a later date, or closed primarily at the time of surgery. When in doubt, the surgeon should leave the wound open.

If the wound is closed it should be with a nonreactive material, usually a monofilament suture with no tension on the wound edges. The flap should have adequate length for appropriate closure without tension, which requires surgical planning. In the presence of peripheral vascular disease, the surgery must be meticulous with delicate handling of all tissues. Strict aseptic technique should be utilized to avoid wound infection, which may lead to a disastrous result. In the presence of serious infection and ischemia, packing the wound open usually provides a lower rate of wound complications or sepsis. Staging the time and level of amputation is imperative. In the presence of infection, appropriate antibiotics given preoperatively and postoperatively help assure appropriate healing of the wound edges.

Preservation of muscle function is extremely important when a hallux amputation is performed. The surgeon should use great care to preserve the function of the intrinsic muscle attachments to the base of the proximal phalanx. The insertion of the intrinsic muscle attachments are violated in total hallux disarticulation amputation, and there is a high incidence of muscle imbalance, which commonly presents as instability of the first ray that may cause inversion or varus deformity of the foot. In severe foot infection, there may be extensive necrosis of major muscle function necessitating a more proximal amputation such as partial or complete first ray amputation. In more severe cases, a below-knee or above-knee amputation may be necessary.

Painful and disabling stump neuromas are common following amputation. All sensory nerves encountered should be sharply incised at a proximal level, protecting them from any potential external force such as the patient's shoe. The incised nerve ending should be allowed to retract proximally to avoid reinnervation of the skin or distal anatomic structures.

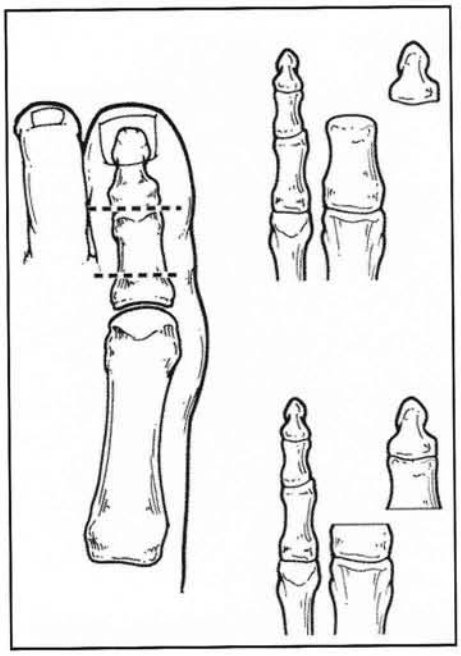

Figure 3. A comparison of disarticulation amputation (right) and osteotomy amputation (left) techniques.

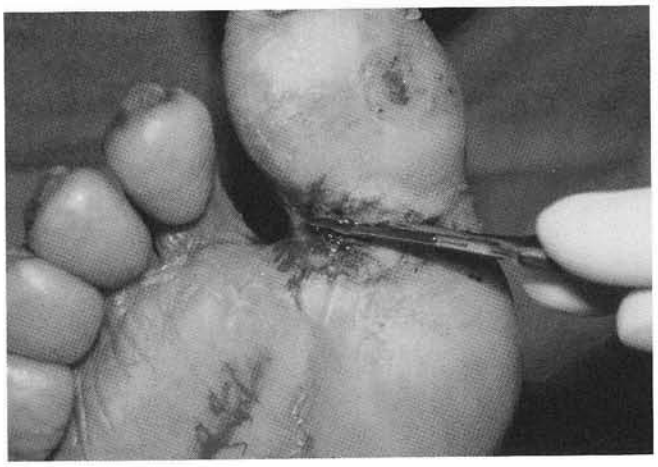

Figure 4. Adequate bleeding was noted at the time of the skin incision, which was a strong indication that the patient had adequate circulation for appropriate healing of the wound following amputation.

Figure 5. The first metatarsal head was identified and disarticulated at the first metatarsal phalangeal joint.

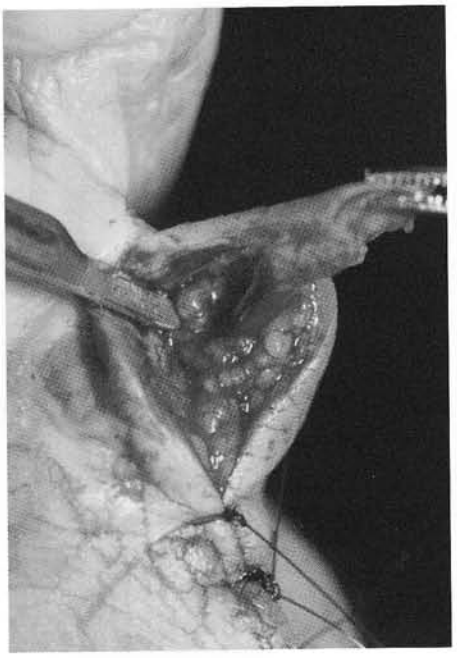

Figure 6. All necrotic and diseased tissue was removed at the time of amputation to prevent further complications from infection, or in more severe cases necrotizing fasciitis.

Figure 7. Frequent lavage with cool sterile water prior to wound closure helped to provide primary wound healing. Note the healthy cartilage on the remaining first metatarsal head prior to wound closure.

Figure 8. Intraoperative cultures including gram stain, culture and sensitivity for aerobes and anaerobes, acid fast stain, and fungal cultures were taken. Amputation specimen was sent for bone cultures and identification of a clean proximal margin. The importance of appropriate bone biopsy to identify a clean margin and bone cultures cannot be over-emphasized.

Figure 9. The surgical area was closed primarily with a non-absorbable synthetic suture and dry sterile compressive dressings were applied, followed by redressing of the wound in three days. Because adequate hemostasis was provided, no tubes or drains were necessary. The patient was discharged from the hospital with instructions for strict non-weight bearing on crutches for 10-14 days followed by partial weight bearing in a surgical shoe.

Figure 10. Two weeks postoperative result following right hallux amputation. Note prior hallux amputation of the left hallux one year previously.

POSTOPERATIVE MANAGEMENT

Most postoperative regimes following hallux amputation initially require strict non-weight bearing of the involved extremity. It is important for the podiatric surgeon to not neglect the contralateral limb, which is at increased risk. This requires frequent monitoring and protective measures. The use of the Cam walker is an excellent regime to progress from a non-weight bearing to a partial weight bearing status. The Cam walker can be used effectively until it is appropriate to advance to the use of a shoe. An extra depth shoe with a prescribed plastizote medial forefoot filler and inlay, combined with a rigid shank is recommended for ambulation following successful healing. The use of a neutral position orthotic device with intrinsic forefoot posting helps to control the potential postoperative forefoot varus position following hallux amputation surgery.

Historically, diabetic patients presenting with a foot ulceration would have had an amputation at a proximal level because of the assumed inability to heal at the level of distal amputations. When an infection has involved the plantar spaces of the foot, it has been believed that the only hope of saving the patient's limb was to perform a guillotine amputation of the affected limb. When a neurotrophic diabetic patient presents with foot ulcerations, it is not always necessary to perform a proximal amputation. Partial forefoot amputations such as a hallux amputation allow the minimum possible amputation at the lowest level with a major advantage of the ability to bear weight.

BIBLIOGRAPHY

Bilk D, Selby JV, et al: Lower extremity amputations in people with diabetes; epidemiology and prevention. *Diabetes Care* 1990;13:513.

Chang B, Bock D, Jacobs R, Darling R, Leather R, Shah D. Increased limb salvage by the use of unconventional foot amputations. *J Vasc Surg* 1994;19:341-9.

Downs DM, Jacobs RL. Treatment of resistant ulcers on the plantar surface of the great toe in diabetics. *J Bone Joint Surg Am* 1982;64:930-3.

Duggar, GE, et al. Time-Line for the diabetic foot. In: McGlamry ED, editor. Podiatry Institute Update 1987. Tucker (GA): Podiatry Institute Publishing; 1987.

Fronek A, Coel M, Bernstein EF. The importance of combined multi-segmental pressure and Doppler flow velocity studies in the diagnosis of peripheral arterial occlusive disease. *Surgery* 1978;84:840-7.

Gavin, LA. Perioperative management of the diabetic patient: endocrinology and metabolism *Clin N Am* 1992;21:457-75.

Goldstein B, Citron D, Neshit C. Diabetic foot infections. *Diabetes Care* 1996;19:638-41.

Griffiths, GD, Wieman, TJ. Meticulous attention to foot care improves the prognosis in diabetic ulceration of the foot. *Surgery Gyn Obst* 1992;174:49-51.

Lance B, Kirschenbaum S. Distal ischemia with digital gangrene secondary to buerger's disease. *J Foot Surg* 1991;30:534-41.

Levin M. Foot lesions in patients with diabetes mellitus. *Chron Comp Diab* 1996;25:447-55.

Levin ME, O'Neil LW. The Diabetic Foot. St. Louis: CV Mosby; 1988. p. 17.

Pinzur MS, Gold J, Schwartz D, et al. Energy demands for walking in dysvascular amputees as related to the level of amputation. *Orthop* 1992;15:1033-7.

Pinzur MS, Sage R, Abraham M, et al. Limb salvage in infected lower extremity gangrene. *Foot Ankle* 1988;8:212-5

Sizer JS, Wheelock FC. Digital amputations in diabetic patients. *Surgery* 1972;72:980-9.

Vitti M, Robinson D, Hauer-Jensen M, Thompson B, Ranval T, Barone G, et al. Wound healing in forefoot amputations: the predictive value of toe pressures. *Ann Vasc Surg* 1994;8.