Case Report and Surgical Technique: Closure with a Filleted Hallux Flap after Transphalangeal Amputation of the Big Toe for Osteomyelitis in the Diabetic Foot

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Abstract
Wound closure for the tissue defect caused by amputation of digit, for a diabetic foot is challenging. We describe a surgical technique and a case report of filleted hallux flap in the management of post amputation defect aosteomyelitic diabetic foot wound. This reproducible technique needs comparatively minimal technical complexity and is a good option in the management of diabetic foot wounds where soft tissue coverage is required.

Introduction
Alpert and Buncke were the first surgeons who described the concept of fillet flaps in 1978, while treating mutilated hand injuries. they used a microvascular free flap from a non-replantable part for reconstruction. Fillet flaps are axial pattern flaps that are harvested from non-functioning or unsalvageable osseous and soft tissue structures. These can then be used as a pedicle is land, or microvascular free flaps for reconstruction and are commonly used in the settings like trauma 1.

Kuntscher et al. have described the concept of fillet flaps in their series of 50 finger and toe fillets2. This concept has been extended to non-traumatic conditions, such as defects caused by large pressure sores or by extensive tumor resection. Here the flaps are raised from anatomically intact limbs 3-5.

Routinely the open wounds caused by diabetic foot infections are left to heal by secondary intention or by negative pressure wound therapy. This is due to poor vascularity of the foot 6.

Fillet flap is one of the options for soft tissue closure in the diabetic foot, can be a primary closure or a staged reconstruction and this depends on the patients vascular status. Advantages of this fillet flap include absence of donor site morbidity, good durability, and leg length preservation, and thus preventing the need
for more proximal amputation for adequate soft tissue coverage. The clinical outcomes of this technique for pressure wounds or selected amputations (forefoot or transmetatarsal) in diabetic patients were proven to be reliable. The purpose of this article is to describe the surgical technique of a filleted hallux flap in the management of closure of soft tissue defect caused by inter phalanx amputation in the osteomyelitic diabetic foot.

Case Report
A 56-year-old female home maker with a history of poorly controlled diabetes mellitus (preoperative hemoglobin A1c of 9.6%) was admitted to the hospital with a 4-week history of non-healing ulcer left foot with prior history of trauma to the left foot. On examination of the ulcer, there is slough, with foul smelling discharge. Erythema and edema were noted over the dorsal and lateral aspect of the left great toe. Dorsalis pedis and posterior tibial pulses were palpable. Debridement of the ulcer with regular dressing done, but the ulcer showed hyper granulation tissue with foul smelling discharge (fig. 1). Chemical cauterization with copper sulphate has been tried, but without much success.

Left foot plain radiographs (fig. 2) showed signs of osteomyelitis, with disruption of inter phalanx joint.

Patient has been scheduled for a partial ray (toe and metatarsal) amputation of great toe, under ankle block using 2% xylocaine solution.

Operative Technique
The surgical procedure was performed under ankle block with patient in supine position. A tourniquet was used for hemostasis. A sterile pillow was placed under the ipsilateral popliteal region to allow for better positioning during the procedure via external rotation of the leg. An incision was made over the medial aspect of the great toe from the tip to the metatarsal joint, thus exposing the bone. The unhealthy bone is then removed. The plantar flap is carefully preserved (fig. 3 & 4), and filleted neurovascular bundles are preserved to ensure flap survival. The filleted skin flap was then approximated dorsally to the wound using a non-absorbable ethilon3-0 suture, covering the exposed bone (fig. 5)
Haemostasis was achieved and a sterile dressing done. The patient was kept non-weight bearing on the left foot for 2 weeks. Analgesia was achieved using oral NSAIDs & paracetamol. Intravenous antibiotics were used for 1 week due to prior infection and immunocompromised state due to uncontrolled diabetes mellitus. Post operatively the wound was inspected for the presence of any dehiscence, flap necrosis, or infection. Sutures were removed 10 days postoperatively.

Results
The diabetic foot wound healing was uneventful. There was no flap necrosis, secondary infections, or wound dehiscence at 10 days post operation. The patient returned to normal house hold chores 3 weeks postoperatively. At 5 weeks follow up, the flap was viable and patient was able to walk independently without pain. There was no flap necrosis, recurrent infection, scar complications and ulceration under the remaining stump of hallux.

Discussion
Wound Healing by Secondary intention or negative pressure wound therapy is commonly the preferred method, but it carries a significant amount of time and cost to patients. Primary closure for diabetic foot infections is rarely performed due to the increased risk of postoperative skin necrosis and poor wound healing secondary to poor vascularity. Hemoglobin levels of more than 10 g/dL and serum albumin of more than 25 g/L are important to ensure good post operative wound healing.

Wound coverage is feasible, if the foot has moderately well perfused vascularity. Nather and Wong suggested essential criteria for distal amputations of the foot, includes the presence of one or two palpable pedal pulses, ABI of at least 0.8, and TBI of at least 0.7. This criteria should be applied before performing surgical reconstruction, which is to ensure good wound healing for the flap reconstruction.

In this case report, wound coverage over the exposed bone following a partial ray amputation great toe was quite challenging. Traditionally, surgical treatment would have been either healing by secondary intention or further amputation proximally. Both these methods lead to increased cost, treatment time, and patient morbidity. Local or distant flap coverage is a viable alternative. The surgical technique described in this case report preserves the phalangeal length and accelerates wound healing, which is important for normal walking and foot pressure distribution. The same method can be applied to other digits. Harvesting the fillet flap, with partial amputation is justified as the next surgical option would have involved amputation of the great toe in a more proximal site. Aerden et al. have described in their case series a primary closure with a fillet flap for the big toe for osteomyelitis of diabetic foot this showed a delayed mean healing time of 44 days with disappointing longterm results, with recurrent ulcers under the remaining metatarsal head.
Our case report did not show any similar complications of ulceration under the remaining metatarsal head.

To conclude, this case report describes the surgical technique of the hallux fillet flap for diabetic foot closure. Advantages include good soft tissue durability and preventing the need for more proximal amputation for adequate soft tissue coverage.

As this is a case report, more patients will be needed to support the concept of filleted hallux flaps in terms of patient selection and clinical outcomes for soft tissue closure of the diabetic foot. Randomized controlled trials comparing patient selection criteria and different methods of flap coverage for partial ray amputations in diabetic patients are needed.

**Conclusion**

The filleted hallux flap reconstruction is a reproducible technique which incurs comparatively minimal technical complexity and thus provides a good option in the management of diabetic foot wounds where soft tissue coverage is required.

**References**


