

Reconstruction of Distal Amputation of the Right Index Finger Using a Kutler Flap: A Case Report

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ABSTRACT

Traumatic fingertip injuries are common in clinical practice and represent a reconstructive challenge due to the need to preserve digital length, sensation, and hand function. Among the various therapeutic options available, the bilateral Kutler V-Y advancement flap is an effective alternative for the reconstruction of small to medium-sized distal defects with limited bone exposure. We present the case of a 34-year-old male patient with a traumatic distal amputation of the right index finger secondary to a workplace accident, resulting in pulp soft tissue loss and exposure of the distal phalanx. Following clinical and radiographic evaluation, reconstruction using a bilateral Kutler V-Y advancement flap was performed. The procedure consisted of debridement of devitalized tissue, design of two lateral triangular flaps based on the digital neurovascular bundles, elevation and distal advancement of the flaps to achieve complete defect coverage, followed by tension-free primary closure. Postoperative recovery was favorable, with no evidence of infection, necrosis, or wound dehiscence. Adequate defect coverage, preservation of digital length, maintained protective sensation, and satisfactory functional recovery were achieved, allowing the patient to return to normal daily activities. The bilateral Kutler V-Y advancement flap remains a reliable, technically straightforward, and low-morbidity reconstructive option that provides favorable functional and aesthetic outcomes in the treatment of traumatic fingertip injuries with limited bone exposure.

KEYWORDS: Kutler flap, V-Y advancement flap, digital reconstruction, fingertip amputation, hand surgery, hand trauma.

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INTRODUCTION

Traumatic fingertip injuries are among the most common conditions encountered in emergency departments, trauma services, and hand surgery units. Because the fingers are involved in virtually all activities of daily living, any injury affecting their anatomical integrity may result in significant functional limitations, particularly in tasks requiring

precision, tactile sensation, and grasping ability. Trauma to the distal region of the fingers commonly occurs as a consequence of occupational, domestic, sports-related, or machinery-related accidents and may lead to soft tissue loss, bone exposure, nail bed injury, and damage to neurovascular structures.

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Reconstruction of fingertip defects represents a challenge for the reconstructive surgeon, as treatment should not only provide adequate coverage of exposed structures but also preserve digital length, maintain sensation, prevent secondary deformities, and achieve an acceptable aesthetic outcome. The fingertip pulp is a specialized structure containing abundant sensory receptors and plays a fundamental role in fine tactile perception; therefore, its reconstruction requires techniques capable of preserving these functional characteristics to the greatest extent possible.

Several therapeutic options have been described for the management of these injuries, including healing by secondary intention, primary closure, skin grafting, and various types of local, regional, and free flaps. The selection of the reconstructive method depends on multiple factors, such as the size and location of the defect, the presence of bone or tendon exposure, the mechanism of injury, the patient's age, hand dominance, and individual functional requirements. For small- and medium-sized distal defects, local flaps are generally considered the first-line option because they provide tissue with similar characteristics, preserve sensation, and are associated with lower donor-site morbidity.

Among the available reconstructive techniques, the bilateral V-Y advancement flap described by Kutler in 1947 has become an effective option for the treatment of transverse and oblique fingertip amputations with pulp tissue loss. This technique consists of creating two lateral triangular flaps based on the digital neurovascular bundles, which are advanced toward the midline to cover the distal defect. Owing to its design, it provides sensate tissue coverage, preserves finger length, and maintains adequate digital function, generally achieving satisfactory aesthetic outcomes.

The advantages of the Kutler flap include its relative technical simplicity, the possibility of being performed in a single surgical stage, preservation of both protective and discriminatory sensation, and a low complication rate when properly executed. However, its indication should be

individualized according to the characteristics of the injury, as extensive defects or substantial tissue loss may require alternative reconstructive options.

The second digit of the hand, also known as the index finger, plays an essential role in precision pinch and numerous functional activities of the upper extremity. Therefore, injuries affecting this structure require reconstruction that ensures both functional recovery and preservation of sensation and digital length. Proper management of these cases is crucial to optimize the patient's return to daily activities and minimize permanent sequelae.

In this article, we describe the case of a patient with a traumatic injury to the right index finger characterized by distal tissue loss involving the fingertip pulp, who was treated with reconstruction using a bilateral Kutler V-Y advancement flap. The clinical characteristics of the injury, surgical technique, postoperative course, and functional and aesthetic outcomes are detailed to highlight the usefulness of this technique as a safe, reproducible, and effective reconstructive option for the management of distal finger defects.

CASE REPORT

A 34-year-old right-hand-dominant male patient with no significant medical history presented to the Emergency Department after sustaining a traumatic injury to the right index finger caused by an occupational accident involving an electric saw. Physical examination revealed a traumatic amputation of the distal portion of the index finger with loss of pulp soft tissue and exposure of the distal phalanx. The amputated segment was unavailable for replantation. The patient reported severe pain and functional impairment of the affected finger. Neurovascular evaluation demonstrated adequate perfusion of the remaining tissues, preserved capillary refill, and intact sensation proximal to the injury site. Radiographic examination showed minimal loss of the distal phalanx without joint involvement or associated fractures.



Figures 1 and 2. Preoperative images



Figure 5. Intraoperative image showing flap dissection.

Due to bone exposure and the impossibility of achieving primary closure without significant shortening of the finger, reconstruction using a bilateral Kutler V-Y advancement flap was selected. The procedure was performed under regional brachial plexus block with placement of a pneumatic tourniquet on the arm. Initially, thorough irrigation with sterile saline solution and debridement of devitalized tissue were carried out, resulting in a clean and adequately vascularized wound bed. The size and configuration of the defect were subsequently assessed, confirming the feasibility of reconstruction using local flaps.

Two lateral triangular flaps were designed along the radial and ulnar borders of the remaining pulp tissue, with a V-shaped configuration and proximally oriented apices. Incisions were then made using a No. 15 scalpel blade through the skin and subcutaneous tissue while carefully preserving the digital neurovascular bundles. The flaps were elevated through sharp and blunt dissection, releasing deep adhesions as necessary to achieve adequate mobility without compromising vascularity. Once dissection was completed, both flaps were advanced distally and medially to completely cover the area of bone exposure. Fixation was achieved with interrupted 5-0 nylon sutures, resulting in stable, tension-free

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coverage. The lateral donor sites were closed primarily, producing the characteristic Y-shaped configuration of this technique. Following tourniquet release, adequate flap perfusion was confirmed, with no evidence of venous

congestion or vascular compromise. A non-compressive sterile dressing and protective splint were subsequently applied.



Figures 6 and 7. Postoperative clinical photographs obtained three weeks after reconstruction with the bilateral Kutler V-Y advancement flap.

The postoperative course was uneventful. During follow-up, no complications such as infection, necrosis, wound dehiscence, or partial flap loss were observed. Sutures were removed two weeks after surgery, demonstrating satisfactory wound healing. At six weeks, the patient exhibited complete defect coverage, preservation of digital length, intact protective sensation, and satisfactory distal interphalangeal joint mobility. At the three-month follow-up evaluation, a favorable functional and aesthetic outcome was observed, with full return to work activities and no residual pain or significant functional limitations.

This case demonstrates that the bilateral Kutler V-Y advancement flap is an effective reconstructive option for the management of distal index finger defects with limited bone exposure, allowing preservation of finger length, maintenance of pulp sensation, and stable coverage through a technically reproducible procedure with low morbidity.

DISCUSSION

Traumatic fingertip injuries represent one of the most common indications for reconstruction in hand surgery because of the functional and sensory importance of this anatomical region. The primary goals of treatment are to

provide durable and stable coverage, preserve digital length, maintain sensation, and allow early return to daily activities. The choice of reconstructive technique depends on factors such as defect size, the presence of bone or tendon exposure, mechanism of injury, and the patient's functional requirements.

In the present case, distal amputation of the right index finger resulted in pulp tissue loss with limited bone exposure, a situation in which the bilateral Kutler V-Y advancement flap represents an appropriate option because it provides local tissue with similar characteristics, preserves sensation, and prevents excessive shortening of the finger. Since its original description by Kutler in 1947, this technique has demonstrated satisfactory results in small- and medium-sized distal defects, particularly in transverse and certain oblique fingertip amputations.

Unlike healing by secondary intention, which may require prolonged healing periods and can result in painful sensitivity or residual deformities, local flaps allow immediate reconstruction with superior functional outcomes. Likewise, compared with skin grafts, flaps provide vascularized tissue and preserve better sensation, which is essential for optimal hand function.

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Table 1. Reconstructive Goals in Fingertip Injuries

Goal	Clinical Significance
Coverage of exposed structures	Prevents infection and osteomyelitis
Preservation of digital length	Maintains pinch and grasp function
Preservation of sensation	Allows fine tactile discrimination
Acceptable aesthetic outcome	Improves patient satisfaction
Early functional recovery	Facilitates return to work

Several techniques have been described for reconstruction of distal finger defects, including Kutler, Atasoy, Moberg, cross-finger, and neurovascular flaps. Each has specific indications according to the location and extent of the injury.

Table 2. Comparison of Reconstructive Techniques for Distal Digital Defects

Technique	Main Indication	Advantages	Disadvantages
Kutler flap	Small to medium transverse defects	Preserves sensation and length	Limited advancement
Atasoy flap	Distal volar defects	Good central coverage	Less suitable for larger defects
Moberg flap	Distal thumb defects	Excellent sensation	Risk of residual flexion
Cross-finger flap	Larger defects with bone exposure	Wide coverage	Requires a second-stage procedure
Neurovascular homodigital flap	Complex defects	Excellent sensation	Technically demanding

The Kutler flap offers multiple advantages that explain its continued use within the reconstructive armamentarium of hand surgery. The use of local tissue provides an excellent match in color, thickness, and texture. Furthermore, preservation of the digital neurovascular bundles promotes recovery of both protective and discriminatory sensation. In the present case, these characteristics allowed a functionally satisfactory reconstruction without the need for additional procedures.

Table 3. Advantages of the Bilateral Kutler V-Y Advancement Flap

Advantage	Benefit
Simple technique	Easy surgical reproducibility
Single-stage procedure	Reduced morbidity
Preserves digital length	Improved functional outcome
Preserves sensation	Adequate tactile recovery
Low donor-site morbidity	Fewer sequelae
Coverage with similar tissue	Improved aesthetic outcome

Despite its advantages, the Kutler flap has certain limitations. The main limitation is the restricted amount of distal advancement that can be achieved; therefore, extensive defects may require alternative reconstructive techniques. Additionally, inadequate dissection may compromise flap vascularity or create excessive tension during wound closure.

Table 4. Potential Complications of the Kutler Flap

Complication	Mechanism
Partial necrosis	Vascular compromise
Wound dehiscence	Closure under excessive tension
Hypersensitivity	Abnormal nerve regeneration
Residual pain	Defective healing
Joint stiffness	Prolonged immobilization
Nail deformities	Nail bed injury

In our patient, no postoperative complications were observed, and adequate defect coverage was achieved while preserving both finger length and sensation of the index finger. These findings are consistent with those reported in the literature, where V-Y advancement flaps demonstrate high survival rates and patient satisfaction. The functional recovery

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achieved allowed the patient to return to work within a relatively short period, which is one of the primary goals of digital reconstruction.

Table 5. Outcomes Obtained in the Presented Case

Evaluated Variable	Result
Flap survival	Complete
Defect coverage	Adequate
Preservation of digital length	Yes
Protective sensation	Preserved
Infection	No
Necrosis	No
Reoperation	No
Aesthetic outcome	Satisfactory
Return to activities	Complete

The bilateral Kutler V-Y advancement flap remains a reliable and effective technique for the treatment of distal finger defects with limited bone exposure. Its ease of execution, low morbidity, preservation of sensation, and favorable functional outcomes make it an excellent reconstructive option for traumatic fingertip injuries, particularly in young and professionally active patients such as the one presented in this case report.

CONCLUSION

The bilateral Kutler V-Y advancement flap represents a safe, effective, and reproducible reconstructive option for the management of traumatic fingertip defects with limited bone exposure. Its primary advantage lies in the use of well-vascularized local tissue, which allows preservation of digital length, maintenance of fingertip sensation, and provision of stable coverage with favorable functional and aesthetic outcomes.

In the present case, reconstruction of the right index finger using this technique resulted in satisfactory wound healing, complete defect coverage, preservation of protective sensation, and successful functional recovery without postoperative complications. Furthermore, the patient was able to return to his usual activities with adequate pinch and grasp function.

The outcomes observed support the use of the Kutler flap as a first-line reconstructive option for small- and medium-sized distal finger defects, particularly when preservation of digital length is desired and more complex reconstructive procedures can be avoided. Its technical simplicity, low morbidity, and high success rate continue to establish it as a valuable and contemporary technique within the reconstructive armamentarium of hand surgery.

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