

Modified Atasoy V-Y Flap Advancement Technique in Allen Type 3 Fingertip Amputation

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Abstract

Traumatic fingertip amputations are very common reasons for a visit in the Emergency Department. Considering that the finger is our end organ for distal sensation, proprioception and neurosensory discrimination, the suggested treatment should provide function preservation, acceptable sensation, finger length restoration and few potential complications that could lead to poor function of that finger in the future. Actually, there is no defined consensus over the approach that the clinician should take, whether conservative or surgical.

We report the case of a 22-year-old male patient, presented at the Emergency Department of University Trauma Hospital in Tirana after a transverse Allen type 3 ring fingertip amputation.

Bone loss, injury to the nail bed and plate was observed, with no amputated part retrieved.

Considering the patient's demands and rejection of conservative treatment due to longer healing time, we opted for Atasoy V-Y advancement flap with a little modification to the technique, that included a tension free closure at the tip of the donor site. This reduced considerably the chances of partial or full flap necrosis.

The V-Y advancement flap appears to be a safe, reliable and simple technique to be performed in the Emergency Department OR, with very good cosmetic, functional and neurosensory results postoperatively.

We highly suggest that this technique be taken into account for these type of amputations.

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INTRODUCTION

Fingertip amputations are among some of the most common injuries presented at Trauma Emergency Departments. With the fingertip pulp equipped with special sensory receptors essential to proprioception, every attempt should be made to functionally restore it. A bad to average reconstruction can potentially affect the patient's ability to work, thus causing social and economic costs to the community. Optimal reconstruction preserves the finger length without additional bone loss, sensation, function, and enables a quick return to work. Many reconstructive techniques have been described for either dorsal or transverse fingertip amputations. However, the Atasoy V-Y advancement flap has remained a frequently used one.

The V-Y advancement flap was originally described by Tranquilli-Leali in 1935 (1), but was first reported in the United States by Atasoy et al (2) in 1970.

Under tourniquet control and using an appropriate anesthetic, a distally based triangle is cut through the pulp skin only, with the base of the triangle equal in width to the cut edge of the nail. Then, a full-thickness flap is developed with nerves and blood supply preserved. The fibrous fatty subcutaneous tissue is then carefully separated from the periosteum and flexor tendon sheath using sharp dissection.

The vertical septa that hold the flap in place are selectively cut and the flap is advanced distally.

The skin flap is sutured to the sterile matrix or nail under normal tension. The base of the

triangle is sutured to the nail bed and the v shaped donor site is then closed as a Y. With large defects, this can compromise the vascularity at the tip of the triangle flap. The senior authors of this article, have observed during the years, occasionally, partial or complete flap necrosis has occurred when the flap was sutured by residents in a high tension fashion. The main concern was the tension at closure, following strict adherence to the classic closure method. Main problem resulted from the swelling that followed closure and after discharge from Trauma ED (Figure 1, 2).

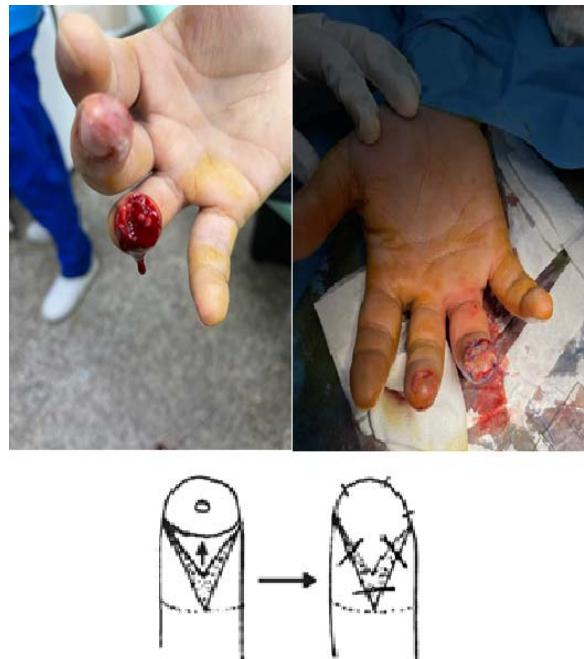


Figure 1. Patient's transverse fingertip amputation, surgical repair and technique display



Figure 2. Atasoy V-Y technique

CASE REPORT

A 22 years old man presented at the Trauma University Hospital Emergency Department following an amputation of his right ring fingertip. He stated that he was working at his garden with an electric saw, when it slipped off his hand and unfortunately ripped his fingertip away. The amputated part of his finger was not retrieved. His medical, surgical, family history was unremarkable and he was not a smoker. Upon his presentation, a transverse amputation of the right ring fingertip was noted with damage to the nail plate and bed, and also bone loss of the distal phalanx confirmed on x-ray taken in the ER. Bone exposure was noted as well with no bony spikes present. Tetanus Immunoglobulin-VF was administered and intravenous antibiotics were initiated. Patient informed consent was obtained

prior to surgery, including consent for the possible publication of this case report. The attending physician was notified and the resident performed the procedure under supervision. Extensive irrigation with sterile normal saline water and diluted betadine were applied under regional digital block with Lidocaine 1%, and a proximal tourniquet. Sterile prepping and draping were applied prior to initiating surgery. Debridement to any devitalized tissue was performed. All the steps of the procedure, as previously described, were followed strictly until the suturing part of the flap. It is important to highlight that the engagement of the flap is highly dependent on the division of the septal attachments. Upon the incision of the dermis and the subcutaneous fat became visible, further dissection was stopped. This ensured protection of the neurovascular bundles.

Essentially, the flap was freed to allow it to move distally, enough to close the defect under normal tension. After the flap was advanced over the defect, the V shaped donor site was approximated to the nail bed at the base of the triangle. The other areas, opposed to the classic suturing of the Atasoy V-Y plasty, were sutured loosely and sparingly (with just one suture each) *in situ* just enough to keep it in place (tension free). This site could have been left as it was without a suture on it as shown by Thoma et al. in his technique modification, but considering the edema following manipulation and possible skin retraction, we needed to take a precaution.

The open wounds proximally and distally were then covered with a single layer of Ialuset plus (Genevrier, France) dressing, followed by a layer of dry dressing. Ialuset plus is a sterile, non adhering fine mesh gauze that has some healing, bacteriostatic and bactericidal properties due to silver sulfadiazine and hyaluronic acid. Its properties provide a moist environment that leads to healing and prevents the wound from getting contaminated (3). At the first follow-up visit, which occurred 24 h postoperatively, the dressing was removed down to, including the Ialuset gauze. The finger is bathed each day after the 5th day with saline water for a minute without removing the Ialuset gauze (if it fell, the patient changed it) and then redressed with a dry gauze. In our experience by 14 days postoperatively, the wound was found to be healed with some crusts on it and sutures were taken out (Figure 3). By 4 weeks, epithelialization was found to be almost complete and also some granulation tissue at the tip of the V flap. By 6 weeks the wound was completely healed and remodeling had started. Cold intolerance was reported by week 10. By 12 weeks the wound was well remodeled and objective neurosensory evaluation was assessed using 2 PD (point discrimination) of the affected finger and contralateral one. Static 2PD was 6 mm. Range of motion was fully restored and cold intolerance was evaluated by CISS questionnaire (Irwin et al., 1997) with a score of 24.



Figure 3. Wound at 2, 4 and 12 weeks postoperatively

DISCUSSION

We present a case of an Allen type III fingertip amputation injury which was managed surgically. At 4 weeks epithelialization was found to be almost complete, and at 6 weeks it had some remodeling with excellent functional and aesthetic results. There are 2 type of management for these type of injuries: surgical and conservative. Management of this type of injury depend not only on the wound size and tissue loss but also on the country or region.

In the US conservative management or revision is the standard of care (5-7).

Replantation or reconstruction is preferred in Asian countries (6-8).

In our country, these type of injuries are usually treated with a reconstruction, and revision rarely occurs. These differences are usually based on multiple factors, mostly cultural and religious (6,7,9).

Also differences in health care systems, readiness of medical supplies, patient compliance, training and also insurance reimbursement, may influence the management choices (9).

As mentioned above, in some countries the surgical management of these injuries may have been excessively aggressive (7).

On the other hand, conservative management using moist wound dressings has become common and widely accepted among the general public in recent years (10). In this case, considering patient was demanding on the fastest recovery possible, we opted for surgical management combined with moist wound dressing as we thought this would provide better outcomes than leaving it to heal by second intention. We had reviewed many articles regarding necrosis of the flap after Atasoy V-Y advancement technique that report up to 6.6% of flap necrosis (4) and also based on our previous experiences.

We used the Ialuset Plus sterile gauzes (Hyaluronic acid and Silver Sulfadiazine) as an adjuvant to keep the proximal graft area moist and free of possible infection. Silver sulfadiazine was used as an occlusive dressing for secondary healing in combination with another moisture agent as described by deBoer, P and Collinson in 1981, Buckley,SC and Das in 2000, Riyat, MS et

al in 1977. Currently, there are many moist wound dressings that can help facilitate the healing process but these vary by country and there is no consensus on which to use over another.

Regarding the healing time, surgical management can provide shorter healing times than other management methods (6,7). Conservative management of this type of injury would require at least 12 weeks to heal (11).

Fingertip amputation with exposed bone takes the longest to heal (12,13). In our case, it took 6 weeks for complete healing to occur, which may have been associated with the size of the defect and exposed bone (11).

In a study (14) 200 patients were treated with equal groups of secondary healing, split-thickness skin graft (STSG), full-thickness skin grafts (FTSG), V-Y advancement flap, Kutler flaps, revision amputation, and cross-finger flaps (level III evidence study). They concluded that the best surgical results came from the V-Y advancement flaps. Also, secondary conservative healing was rated as excellent in terms of surgical complications, aesthetic and sensation, with the only downsides being the length of time to heal, scar tenderness and hook nail deformity compared to the surgical groups. Although, these patients had the fastest average time return to work. The V-Y advancement flap was best in cosmetic appearance compared to all groups and ahead of conservative secondary healing group. Grip and pinch was the same between the groups.

Many studies on fingertip amputation, with an exposed bone like in our case recommend surgical management of the injury or bone shortening prior to conservative management, which in our case was unacceptable by the patient (15,16).

In contrast, other studies reported that the protruding bone should not be resected unless it has sharp bone spikes. This is because bone shortening causes the fingertip to lose bony support and can cause a hook nail deformity (13). In this case, exposed bone shortening was not necessary, considering the graft we used glided enough to be sutured to the nail bed, and subsequently was not performed. As a result, there was no nail deformity.

Surgical repair has been reported to be essential in any nail bed injury (17), as this case indicated as well.

The results of V-Y advancement flaps are satisfactory. Cold intolerance and hypersensitivity are usually present (13%), but they improve over time (4,18,19).

The sensitivity is also acceptable, with an average difference of less than 3 mm in two-point discrimination. Return to work after reconstruction with V-Y advancement flaps range between 1 to 2 months.

Cold intolerance is reported in both conservative and surgical treatment of this type of injury (6,12).

However, cold intolerance is assumed to be due to vascular insufficiency and peripheral nerve injury at the time of the fingertip injury,

regardless of the treatment method (5). In this case, cold intolerance and numbness did not affect the patient's daily activities. Over time, both issues resolved positively.

Reconstruction using local flaps has the advantage of being able to handle various types of fingertip amputations and preserve the finger length; however, it also requires a prolonged immobilization and risks flap failure (5,7,12).

CONCLUSIONS

Surgical treatment of fingertip amputations with the Atasoy V-Y advancement technique is a recommended treatment with a satisfactory patient outcome. This technique has been used for Allen type II-IV fingertip amputations as mentioned throughout literature. But, when choosing to perform this technique, it should be taken into account that excessive tension on both the tip and the base of flap will result in donor site necrosis and also failure of the graft. The technique should be selected carefully depending on the nature, degree, size of injury and patient's demands. This technique has good neurosensory outcomes, with little complications and the cosmetic result being the best among different management types.

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Conflict of Interest Statement: The authors declare that they have no conflict of interest.

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