**Journal of Community Health Provision**
**Vol. 6, Issue 3, 2026**
*Page 875-885*
DOI: https://doi.org/10.55885/jchp.v6i3.1066

# Salvaging the Right Middle Finger with an Abdominal Flap Following Degloving Injury and Traumatic Amputation at the DIP Joint: A Case Report

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**Abstract.** *Degloving injury represents one of the most challenging forms of hand trauma. Various salvage strategies have been described in the literature, including primary reattachment of avulsed skin, reconstruction using free flaps and full-thickness skin grafts (FTSG), as well as replantation and microvascular revascularization, with the choice of technique depending on the specific characteristics and severity of the injury. However, no single reconstructive method has been universally established as the gold standard; therefore, treatment should be individualized with the primary aim of preserving tissue viability and optimizing functional outcomes. A 39-year-old man was referred from a type B hospital in Parepare, presenting with an open injury of the right middle finger following a ring avulsion injury. The injury occurred when the ring worn on the patient's middle finger became caught on the metal handle of a pickup truck while he was stepping out of the vehicle, resulting in avulsion of the skin and subcutaneous tissue of the affected digit. At the time of injury, the patient was unaware of the detached soft tissue, and the avulsed tissue was not retrieved or brought to the hospital. The patient initially presented to a type C hospital for primary management, was subsequently referred to a type B hospital, and was finally transferred to Makassar for definitive treatment. Skin loss due to traumatic amputation. The patient underwent abdominal flap reconstruction. The results show that the salvage procedure successfully preserved the right middle finger up to the level of the middle phalanx, maintaining digit length despite residual postoperative stiffness. Initial management and available healthcare facilities play a crucial role in determining the feasibility of replantation as well as the selection of appropriate salvage reconstructive options for degloving injuries.*

**Keywords**: *Degloving Injury, Ring Avulsion, Flap Abdominal*

Received: June 26, 2026 Received in Revised: July 27, 2026 Accepted: September 3, 2026

## INTRODUCTION

The hand is one of the parts of the body that plays the most important role in daily life as the main tool for interacting with the surrounding environment (Katić et al., 2016; Kourtesis, 2024; Pandey & Gelin, 2018). As an integral part of the upper extremity, the hand has a very complex anatomical and biomechanical structure, which allows a combination of strength, dynamic stability, coordination and precise movement (Wang & Amirouche, 2025; Nguyen et al., 2025; Kerkhof et al., 2022). This ability allows humans to carry out various activities, from simple to complex. Due to the high frequency of use and exposure to various activities, the hands are also

one of the parts of the body that are most frequently injured, ranging from minor injuries to serious injuries, with the most common causes being work accidents, followed by injuries from household accidents (Barbiellini Amidei et al., 2022; Pamuk et al., 2025; Dębski & Noszczyk, 2021).

One form of serious injury to the finger is ring avulsion injury, namely the ring getting caught in the finger so that the soft tissue is peeled off or pulled out of the bone framework (Ahmad & Heng, 2018). This injury causes digital degloving, a circumferential loss of skin and soft tissue that causes exposure of deep structures such as tendons, blood vessels, nerves and bones. Although this case is relatively rare, it is one of the biggest challenges in hand reconstruction surgery because it involves extensive soft tissue loss which can cause functional impairment. In more severe cases, this injury can be accompanied by a traumatic amputation that requires immediate treatment and rescue efforts to maximize the chances of successful reconstruction. (Warwick et al., 2021; Rigal et al., 2025; Vogt et al., 2025).

Rescue depends on the mechanism of trauma, extent of tissue damage, availability of viable tissue. Several degloving injuries were previously reported, such as in the case reported by Mourafiq et al. (2026) performed a rescue by repositioning a degloving injury on a hand caught in a machine, another case by Nigam et al. (2025) circumferential degloving injury to the left index finger showing total bone exposure of the middle and distal phalanx, as well as partial exposure of the proximal phalanx requiring reconstruction using a free flap and full-thickness skin graft (FTSG), and the case reported by Pamuk et al. (2025) requires replantation and microvascular revascularization to maintain as much hand function as possible due to severe avulsion injuries with multiple amputations. Although various reconstruction options have been reported, until now there is no method that is considered to be the gold standard in the management of degloving injuries (Pamuk et al., 2025; Vogt et al., 2025; Mourafiq et al., 2025).

## METHODS

A 39-year-old male patient was referred from a Type B Hospital in Pare-pare with an open wound on his middle finger, after a ring caught on a car handle. The patient held onto the car's tailgate and jumped out of a modified pickup truck. The ring peeled off the skin and subcutaneous tissue from the patient's finger. The patient was immediately transported without realizing any remaining tissue. Skin and tissue were not removed. Following the injury, the patient received initial treatment in the emergency room of a Type C Hospital, which included wound cleansing and applying a wet gauze dressing to maintain moisture. The patient was then referred to a Type B Hospital for further evaluation, including radiography, as there were no specialist hand surgery services available at the facility. The patient was then referred to Makassar for further definitive treatment. The wound was accompanied by intermittent, localized pain, worsening with movement and decreasing with rest. There were no other systemic symptoms, such as fever, dizziness, cough, shortness of breath, chest pain, or nausea and vomiting. Urination and bowel movements were within normal limits. There was no history of previous surgery. The patient had no history of chronic illness, allergies, or long-term medication use. He smoked, but no history of alcohol or illicit drug use. His family history did not support the presence of malignancy, chronic disease, or similar bone abnormalities.

On physical examination, his general condition was moderately ill/compos mentis (E4M6V5), blood pressure: 111/64 mmHg, pulse: 68 beats/minute, respiration: 22 breaths/minute, temperature: 36.5°C, SpO2: 99%, VAS: 8/10. Status locus was present in the right hand region. Look: deformity is present (+), soft tissue defect in the third digit of the right hand, peeling of the skin and subcutaneous tissue so that the flexor and extensor tendons are exposed at the level of the base of the proximal phalanx of the third digit of the right hand, and traumatic amputation of the distal interphalangeal joint (DIP) of the third digit of the right hand, granulation tissue is present (+), bleeding is present (+). Feel: difficult to assess due to pain. Move: difficult to assess due to pain. Distal Neurovascular (NVD): cannot be assessed.


 


Figure 1. Preoperative X-ray of the right hand (AP/Oblique): impression of traumatic amputation of the distal phalanx of digit III of the right hand at the level of the distal interphalangeal joint with osseous defect.

Supporting examination, namely an X-ray of the right hand (AP/Oblique), shows a picture of traumatic amputation of the distal phalanx of the third digit of the right hand at the level of the distal interphalangeal joint (DIP), accompanied by a bone defect in the distal fragment.

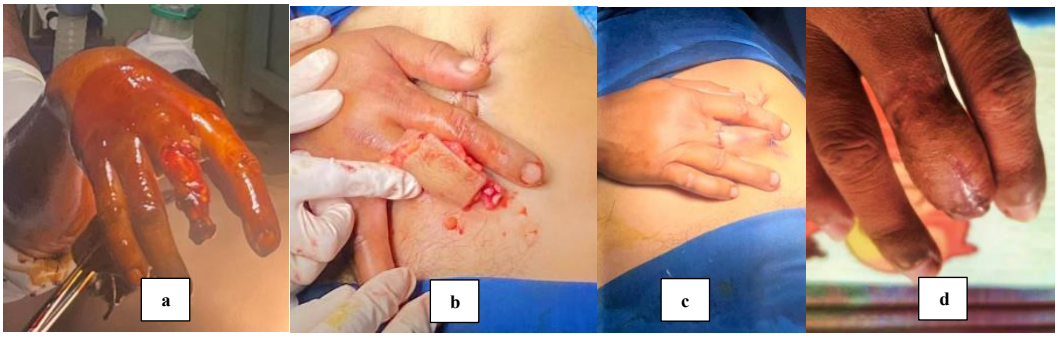


Figure 2. Clinical photographs showing salvage of the middle finger on the right hand. Images (a), (b), (c) show intraoperative skin loss following traumatic amputation, and (d) shows 4 months postoperatively.

The patient suffered an injury and arrived at a type C hospital around 11:00 PM WITA, and was referred to a type B hospital for evaluation, then referred to Makassar. The patient arrived in Makassar approximately 12 hours after the incident and subsequently underwent definitive surgery approximately 22 hours after the injury occurred. Intraoperative clinical features showed an avulsion injury to the right hand digit III with traumatic amputation at the level of the Distal Interphalangeal (DIP) joint, accompanied by extensive soft tissue loss (degloving injury), tendon structure exposure, and skin defect to the level of the base of the proximal phalanx. Disinfection and draping procedures and identification of skin loss on the stump of digit III, excisional debridement to remove excess granulation tissue and crusts, rotational skin flaps, and approximate suturing were performed. Wound care was performed every two days or if seepage was found in the postoperative wound. After undergoing inpatient care for one week, the patient was scheduled for outpatient treatment at the polyclinic. At the fourth-month postoperative follow-up, the wound appeared to have closed, and the salvage procedure was deemed successful in preserving the injured finger. However, joint stiffness and an enlarged finger appearance were


 

still observed due to the bulkiness of the abdominal flap used to cover the defect. The patient was scheduled for further rehabilitation, including physiotherapy to improve finger function and further reconstruction to optimize the aesthetic outcome.

**Injury Pattern and Implications for Digit Salvage**

Ring entrapment can cause a spectrum of injuries, ranging from superficial skin laceration to circumferential soft-tissue avulsion, vascular disruption, tendon exposure, and complete traumatic amputation. In a severe ring-avulsion mechanism, the ring becomes fixed to an external object while the body or hand continues moving. This produces a tangential traction force that acts parallel to the skin surface and separates the skin and subcutaneous tissue from the underlying anatomical structures. When this force is sufficiently strong, it can produce a degloving injury involving the entire circumference of the finger (Singh et al., 2021; Gottlieb et al., 2022; Battiston & Fulchignoni, 2023). The extent of damage may be greater than initially visible because traction can injure the digital vessels, nerves, tendons, and supporting soft tissues beyond the apparent wound margins.

The anatomical characteristics of the finger make circumferential degloving injuries particularly difficult to reconstruct. The palmar skin is thick, tightly attached to the underlying fascia, and relatively inelastic because it is adapted to withstand pressure and friction during grasping. Therefore, a substantial palmar skin defect cannot usually be closed by simply advancing the surrounding tissue. Excessive tension during closure may compromise perfusion, increase the risk of wound dehiscence, and restrict finger movement. By contrast, the dorsal skin may appear more mobile when the finger is extended, but the available tissue becomes limited during flexion. Consequently, even apparently adequate dorsal skin may fail to provide sufficient coverage throughout the full range of finger motion.

Complete detachment of the digital skin is therefore classified as a severe avulsion injury that requires careful assessment of tissue viability and reconstructive potential. The treatment decision depends on the extent of soft-tissue loss, the condition of the vascular and neural structures, tendon and bone exposure, the level of amputation, ischemia duration, and the availability of viable tissue for reconstruction. Depending on these factors, treatment may involve revascularization, replantation, skin grafting, local flap coverage, regional flap coverage, or distant flap reconstruction (Pamuk et al., 2025; Warwick et al., 2021; Rigal et al., 2025; Vogt et al., 2025; Nigam et al., 2025). The primary objective is not merely to achieve wound closure but also to preserve the maximum possible finger length, protect exposed structures, prevent infection, and maintain useful hand function.

In the present case, circumferential digital degloving was accompanied by traumatic amputation at the distal interphalangeal (DIP) joint. The skin and subcutaneous tissue were peeled from the finger to the base of the proximal phalanx, leaving the flexor and extensor tendons exposed. This injury pattern represented a complex reconstructive problem because the defect was extensive, the remaining local skin was insufficient, and the distal segment was no longer available. The combination of soft-tissue loss, tendon exposure, and traumatic amputation increased the risk of infection, tissue desiccation, further necrosis, and loss of the remaining digit if appropriate coverage was not promptly established.

Initial management plays an important role in protecting the injured tissues before definitive reconstruction. Wound irrigation with sterile saline helps remove visible contamination, while moist sterile gauze protects exposed structures and prevents tissue desiccation during transportation and referral (Datarkar & Tayal, 2021; Sibbald et al., 2021; Williams, 2023). Elevation of the injured limb may also help reduce swelling when clinically appropriate. These measures do not replace surgical debridement or definitive coverage, but they may reduce additional tissue damage and maintain a more favorable wound condition until reconstructive treatment can be performed.

ISSN 2776-1150 (Print), ISSN 2776-1169 (online)
 

When traumatic amputation occurs, the detached part should ideally be cleaned carefully, wrapped in sterile gauze moistened with saline, placed inside a waterproof bag, and stored in a cooled container. Direct contact between the amputated part and ice should be avoided because freezing may cause additional cellular and vascular damage. Appropriate preservation is important because the possibility of replantation depends partly on the condition of the amputated segment and the duration of ischemia. Amputated tissue generally has a better prognosis when cold ischemia does not exceed 24 hours and warm ischemia does not exceed 12 hours.

In this case, the patient did not immediately recognize that the distal part of the finger had been amputated. Therefore, the missing segment was neither retrieved nor transported to the hospital, and replantation could not be considered. Management consequently shifted from restoring the amputated distal segment to salvaging the viable remaining finger. This distinction determined the subsequent reconstructive strategy. The objective was to preserve the remaining length, provide stable coverage of the exposed tendons, prevent further tissue loss, and retain as much hand function as possible. The choice of treatment must therefore be individualized according to the depth of the defect, viability of the residual tissue, condition of the recipient bed, functional importance of the injured finger, available surgical expertise, and institutional resources (Barbiellini Amidei et al., 2022; Pamuk et al., 2025; Saracco et al., 2025; Chang et al., 2024; Albash et al., 2026).

**Rationale for Abdominal Flap Reconstruction**

Soft-tissue reconstruction can be performed using either a graft or a flap, but these approaches differ fundamentally in their vascular characteristics. A graft is transferred without its own vascular pedicle and must obtain a new blood supply from the recipient bed. A flap, in contrast, consists of vascularized tissue transferred while maintaining an intact blood supply, either through a pedicle or microsurgical vascular anastomosis (Wu et al., 2025; Bonetti & Egro, 2024; Rogoń et al., 2024). This distinction is particularly important when selecting coverage for wounds with exposed tendons, bones, joints, or neurovascular structures.

A skin graft requires a well-vascularized recipient bed to survive. Although grafting may be appropriate for superficial wounds with preserved vascular tissue, its reliability is reduced when the wound contains extensive tendon exposure without an adequate vascularized covering. In the present case, the flexor and extensor tendons were exposed over a long segment of the injured finger. Consequently, a skin graft alone would not have provided sufficiently reliable coverage or durable protection for these structures. Primary closure was also unsuitable because the circumferential tissue loss extended to the base of the proximal phalanx, leaving insufficient local skin to achieve tension-free closure.

Excessive tension during primary closure could have compromised blood circulation at the wound margins and increased the risk of tissue necrosis, dehiscence, infection, and restricted movement. The extensive nature of the defect also limited the use of smaller local flaps from the injured finger or adjacent areas of the same hand. Therefore, a distant flap was required to provide an adequate volume of vascularized tissue capable of covering the entire defect. Extensive soft-tissue loss, tendon exposure, and the inability to perform tension-free primary closure supported the selection of an abdominal flap in this case (Bertolini et al., 2023; Arcieri et al., 2024; Murhula et al., 2025).

The abdominal flap provides well-vascularized skin and subcutaneous tissue that can be used to cover extensive hand and finger defects. Its relatively abundant tissue allows the surgeon to create a flap large enough to protect exposed structures and preserve the remaining digit. The transferred subcutaneous tissue also provides cushioning over the tendons and bone, which is important for producing durable coverage. In this patient, the flap enabled the exposed structures to be covered without excessive tension and provided a biological environment that supported wound healing.

ISSN 2776-1150 (Print), ISSN 2776-1169 (online)
 

Another important advantage is that the abdominal flap does not require microsurgical vascular anastomosis. This characteristic makes it a practical reconstructive option when microsurgical equipment, specialized personnel, or suitable recipient vessels are unavailable. The donor site is also relatively concealed and can generally be closed primarily, reducing the aesthetic effect of the donor wound. Furthermore, the procedure can be performed using established reconstructive principles and may require a shorter initial operating time than complex free-tissue transfer. These advantages explain why abdominal flaps remain relevant for extensive hand defects, particularly in healthcare settings with limited microsurgical resources (Pamuk et al., 2025; Giele & Cassell, 2016; Adani et al., 2022).

Nevertheless, the abdominal flap also has important disadvantages. Because the injured hand must remain attached to the abdominal donor site until adequate vascular integration occurs, the patient requires prolonged immobilization in a restricted position. This can cause discomfort, complicate nursing care, and limit daily activities. Wound observation and dressing changes may also be more difficult because the hand and abdomen remain connected. In addition, treatment generally requires more than one operation, including flap elevation and inset followed by pedicle division and final positioning.

Prolonged immobilization is particularly relevant in finger reconstruction because the joints and tendons are highly susceptible to stiffness and adhesion. Even when the flap survives and the wound closes successfully, reduced movement during healing may result in limited range of motion. The thickness of abdominal skin and subcutaneous tissue may also produce a bulky finger contour. This bulk can interfere with movement, reduce dexterity, and produce an appearance that differs from the original finger. Secondary contouring procedures may therefore be needed after complete wound healing.

In the present case, the wound was completely covered and the injured finger was preserved at the four-month postoperative follow-up. These findings indicate that the abdominal flap fulfilled its primary purpose of providing vascularized coverage and preventing loss of the remaining digit. However, joint stiffness and an enlarged finger contour were still present. These findings demonstrate that successful reconstruction cannot be evaluated only according to flap survival or wound closure. Functional movement, tendon gliding, sensory recovery, finger contour, and the patient's ability to perform daily activities must also be considered. Thus, the abdominal flap provided a practical and effective solution for initial salvage, although additional rehabilitation and secondary reconstruction remained necessary to optimize the final outcome.

**Timing, Clinical Outcome, and Rehabilitation Considerations**

The timing of soft-tissue reconstruction is an important consideration in severe extremity injuries. Early reconstruction can reduce the duration of exposure of tendons, bones, joints, and neurovascular structures. It may also limit bacterial contamination, edema, tissue desiccation, inflammation, and fibrosis. In this case, definitive surgery was performed approximately 22 hours after the injury because the patient underwent a multistage referral process. The patient was initially taken to a Type C hospital, transferred to a Type B hospital for radiographic evaluation, and subsequently referred to Makassar because appropriate hand surgery services were unavailable at the previous facilities.

Although definitive treatment was not performed immediately after the injury, the reconstruction remained within the first 72 hours. This period has been described as favorable for soft-tissue coverage because early reconstruction may reduce infection, edema, and tissue fibrosis (Le et al., 2024; Habarth et al., 2025; Daza et al., 2026). The 22-hour interval in the present case was therefore considered clinically acceptable, particularly given the limitations of the referral pathway and the need to transfer the patient to a facility capable of performing definitive reconstruction.

During the referral period, the wound was covered with sterile moist gauze. This measure was important for preventing desiccation of the exposed tendons and remaining soft tissue.


 

Maintaining a moist wound environment may also help preserve tissue viability and facilitate subsequent surgical assessment. However, wound coverage during transportation does not eliminate the potential effects of delayed definitive treatment. Tissue trauma, contamination, swelling, inflammation, and the period of immobilization may still influence wound healing and functional recovery.

The abdominal flap used in this case was designed as a random-pattern flap with an approximate length-to-width ratio of 1:1 (Younes et al., 2022; Anolik & Sacks, 2021; Wang et al., 2025). Maintaining an appropriate relationship between flap length and width is essential because a random-pattern flap depends on the subdermal vascular plexus rather than a specifically identified axial vessel. An excessively long or narrow flap may have inadequate perfusion at its distal portion and increase the risk of ischemia or necrosis.

Before flap placement, excisional debridement was performed to remove granulation tissue, crusts, and nonviable tissue. Adequate debridement is necessary to create a clean recipient bed and reduce the risk of infection. The flap was then elevated, transferred to the defect, and sutured into position. Approximation of the wound and donor area had to be performed carefully to avoid excessive tension. Stable immobilization was also essential because movement between the hand and abdominal donor site could disrupt the sutures, compromise the pedicle, cause bleeding, or interfere with flap integration.

The flap edges were subsequently adjusted and reinserted after adequate attachment had developed. In certain cases, an additional procedure may be required when excessive fibrotic tissue or flap bulk remains in the reconstructed area. Therefore, abdominal flap reconstruction should be understood as a staged treatment rather than a single definitive operation. The first stage prioritizes tissue survival and coverage, while the subsequent stages focus on flap separation, contour refinement, and functional optimization.

The technique offers several clinical advantages, including a relatively short initial operating time, preservation of donor-site function, and the absence of a requirement for microsurgical reconstruction. These features are important in cases involving limited resources or when complex microsurgery is not considered feasible. However, the technique also requires prolonged immobilization, potentially difficult wound care, multiple surgical stages, and a longer overall treatment period. The attached position of the upper extremity may prevent elevation and contribute to swelling. Moreover, limited movement increases the risk of joint stiffness, tendon adhesion, and reduced hand function (Pamuk et al., 2025; Giele & Cassell, 2016; Caprielova, 2022).

At the four-month postoperative follow-up, the wound had closed and the remaining finger was successfully preserved. This outcome indicates that the flap provided stable and viable coverage despite the extensive soft-tissue injury and the delayed referral process. Preservation of the middle finger may contribute to maintaining hand width, grasping capacity, and overall hand function. However, joint stiffness and a bulky finger contour remained evident. These residual problems are consistent with the limitations of prolonged immobilization and the thickness of the transferred abdominal tissue.

Postoperative rehabilitation is therefore an essential component of the overall reconstructive process. Physiotherapy should focus on gradually restoring the range of motion, preventing joint contracture, improving tendon gliding, strengthening the hand, and supporting the return to daily activities. Rehabilitation should be adjusted according to flap stability, wound healing, pain, and the condition of the remaining joints and tendons. Regular clinical evaluation is also necessary to monitor tissue viability, identify complications, and determine whether secondary reconstructive procedures are required.

Secondary flap contouring may be considered after the transferred tissue has healed and developed a stable blood supply. This procedure may reduce excessive bulk, improve the appearance of the finger, facilitate movement, and enhance functional use. However, any


 

additional reconstruction should balance aesthetic improvement against the risk of compromising flap circulation or damaging the protected underlying structures. The timing and extent of secondary surgery should therefore be individualized according to tissue condition, functional limitations, and patient expectations.

The outcome of digit salvage should ultimately be evaluated using both anatomical and functional criteria. Wound closure and flap survival represent essential early outcomes, but they do not fully describe recovery. Range of motion, pain, sensation, grip strength, dexterity, ability to perform daily activities, aesthetic satisfaction, and quality of life are also important. In this case, successful wound closure and preservation of the finger represented positive short-term outcomes, whereas stiffness and flap bulk indicated that recovery was not yet complete.

Because this report describes a single patient with a four-month follow-up period, its findings should be interpreted cautiously. The case demonstrates the feasibility of using an abdominal flap to preserve a severely injured finger when replantation is impossible and microsurgical reconstruction is unavailable or unsuitable. Nevertheless, it does not establish the superiority of this technique over local, regional, or free-flap reconstruction. In addition, standardized assessments of range of motion, sensory recovery, grip strength, dexterity, and patient-reported outcomes were not provided. Longer follow-up and objective functional evaluation are therefore required to determine the final functional and aesthetic results.

## CONCLUSION

This case demonstrates that an abdominal flap can provide reliable soft-tissue coverage and preserve the remaining length of a severely injured finger following circumferential degloving and traumatic amputation at the distal interphalangeal joint, particularly when the amputated segment is unavailable and microsurgical reconstruction is not feasible. The selection of this technique should be individualized according to the injury mechanism, extent of tissue loss, condition of the exposed structures, tissue viability, available facilities, and surgical expertise. Although complete wound closure and digit preservation were achieved at the four-month follow-up, residual joint stiffness and flap bulk indicate that anatomical salvage does not necessarily represent complete functional recovery. Continued physiotherapy, objective functional evaluation, longer follow-up, and possible secondary contouring are therefore necessary to optimize mobility, hand function, and aesthetic outcomes.

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ISSN 2776-1150 (Print), ISSN 2776-1169 (online)
 