

ABDOMINAL FLAP FOR COMPLEX HAND DEGLOVING INJURY INVOLVING MULTIPLE DIGITS AND CARPAL REGION : A CASE REPORT

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ABSTRAK

Cedera degloving pada tangan merupakan bentuk trauma berat yang ditandai oleh terlepasnya kulit dan jaringan subkutan dari struktur di bawahnya, umumnya akibat kecelakaan industri berenergi tinggi. Laporan ini menyajikan kasus seorang perempuan usia 21 tahun dengan cedera degloving yang melibatkan jari ketiga, keempat, kelima, serta sebagian regio karpal akibat insiden kerja yang melibatkan mesin penggiling daging. Pendekatan bedah bertahap diterapkan, dimulai dari reduksi terbuka, fiksasi internal, dan debridement, dilanjutkan pemasangan flap abdomen, hingga tahap pelepasan flap. Flap abdomen memberikan penutupan jaringan lunak yang stabil, mempertahankan struktur anatomi tangan, dan memungkinkan proses rehabilitasi progresif. Meskipun terdapat fusi sementara pada jari dan keterbatasan gerak jari telunjuk, rehabilitasi lanjutan dan perencanaan pemisahan jari dilakukan untuk memaksimalkan pemulihan fungsi. Flap abdomen merupakan pilihan rekonstruksi yang andal pada cedera tangan luas, terutama saat teknik mikrobebedah tidak tersedia atau tidak memungkinkan. Kasus ini menegaskan efektivitas dan fleksibilitas teknik flap abdomen pedikulat dalam menyelamatkan ekstremitas tangan berat sembari mempertahankan integritas struktural dan fungsional. Laporan ini juga menyoroti pentingnya intervensi dini, pemantauan pascaoperasi, serta rehabilitasi terarah dalam mencapai hasil optimal pada cedera tangan kompleks.

Kata kunci : cedera degloving, cedera kerja, flap abdomen, rekonstruksi bedah, trauma tangan

ABSTRACT

Hand degloving injuries represent a severe form of trauma characterized by the avulsion of skin and subcutaneous tissue from the underlying structures, often caused by high-energy industrial accidents. This report presents the case of a 21-year-old female with a degloving injury affecting the third, fourth, and fifth fingers as well as part of the carpal region, sustained in a workplace incident involving a meat grinder. A staged surgical approach was employed, beginning with open reduction, internal fixation, and debridement, followed by abdominal flap placement and eventual flap release. The abdominal flap provided durable soft tissue coverage, preserved hand anatomy, and allowed progressive rehabilitation. Despite the temporary fusion of fingers and limited index finger mobility, ongoing rehabilitation and surgical planning for finger separation were initiated to optimize functional recovery. Abdominal flaps offer a reliable reconstructive solution in extensive hand injuries, particularly when microsurgical techniques are unavailable or contraindicated. This case highlights the versatility, efficacy, and practicality of the pedicled abdominal flap technique in salvaging severely damaged hands while maintaining structural and functional integrity. The report also emphasizes the importance of early intervention, vigilant postoperative care, and tailored rehabilitation to ensure optimal outcomes in complex hand trauma. This clinical experience may serve as a reference for reconstructive planning in similar extreme injuries.

Keywords : abdominal flap, degloving injury, hand trauma, occupational injury, reconstructive surge

INTRODUCTION

Occupational hand trauma remains a leading cause of upper limb disability among individuals in the productive age group. Degloving injuries to the hand result in extensive

damage to the skin, subcutaneous tissue, blood vessels, nerves, and osteotendinous structures.(Ilenghoven et al., 2024; Krishnamoorthy & Karthikeyan, 2011; Wang et al., 2013) The mechanism of injury typically involves high-energy blunt trauma, such as entrapment of the hand in industrial machinery. Significant soft tissue loss increases the risk of infection, necrosis, and long-term functional impairment. Therapeutic approaches must address the need for extensive soft tissue reconstruction to facilitate optimal healing and preserve extremity function.(Hakim et al., 2016; Jayant et al., 2023; Krishnamoorthy & Karthikeyan, 2011)

Abdominal flaps are frequently employed as a reconstructive option when conventional skin grafting is not feasible due to inadequate recipient bed conditions. The wide donor area, reliable vascularization, and capacity to provide full coverage make this technique advantageous in managing complex hand injuries.(Ilenghoven et al., 2024; Krishnamoorthy & Karthikeyan, 2011; Lekuya et al., 2018) The compartmented abdominal flap has been developed to improve hand contour and minimize tissue mismatch. In cases of multiple finger degloving injuries involving the carpal region, this flap selection allows for preservation of anatomical structures and prevention of amputation.(Afshar et al., 2023; Krishnamoorthy & Karthikeyan, 2011) Major challenges include infection risk, the need for intensive monitoring, and potential limitations in mobility due to tissue fusion during healing.(Afshar et al., 2023; Dodakundi et al., 2024; Wang et al., 2013)

This report presents the management of a degloving injury involving three fingers and part of the carpal region in a 21-year-old female following a severe occupational accident. A staged surgical approach was adopted to preserve limb function and prevent permanent disability. Degloving injuries result in the avulsion of skin and subcutaneous tissue, requiring immediate and well-planned reconstruction to restore hand integrity and function. The abdominal flap, due to its robust vascularity and expansive donor surface, has been established as a reliable reconstructive option in cases of complex hand trauma where local flaps or free tissue transfer may be contraindicated.(Dodakundi et al., 2024; Hidajat et al., 2023; Lekuya et al., 2018) The chronological and visual documentation of this intervention is intended to provide a clinical reference for planning complex hand reconstructions while assessing the long-term efficacy of the abdominal flap technique in extreme cases.

CASE REPORT

A 21-year-old female presented to the emergency department following a workplace accident in which her left hand was caught in a meat grinder. She arrived fully conscious, oriented, and complained of severe pain in the left hand accompanied by active bleeding. The primary complaint was a large avulsion wound with exposed deep tissues affecting three fingers and the carpal region. She had no history of chronic illness, including diabetes, hypertension, or bleeding disorders. Her family history was unremarkable for genetic or autoimmune conditions. She worked as a food factory laborer, did not smoke or consume alcohol, and reported no known drug or food allergies. She was not taking any regular medications before the incident.

Physical examination revealed a degloving injury affecting the distal phalanges of the index, middle, and ring fingers, along with partial involvement of the carpal area. The skin was completely separated from the subcutaneous tissue, exposing muscle, bone, and vasculature. No open fractures were identified initially, although deformities and restricted passive movement were observed. Vital signs were stable: blood pressure 120/80 mmHg, heart rate 92 bpm, respiratory rate 20 breaths per minute, body temperature 36.8°C, and oxygen saturation 98% on room air. Systemic examination revealed no other abnormalities.

Initial diagnostic assessments included a left-hand radiograph showing no fractures in the metacarpals or phalanges but indicating severe disruption of soft tissue. Laboratory evaluation

revealed hemoglobin 12.5 g/dL, leukocyte count 11,000/mm³, and platelets 320,000/mm³. Coagulation profile and renal function tests were within normal limits. The working diagnosis was multiple finger degloving injuries secondary to high-energy trauma. Differential diagnoses included partial avulsion, traumatic amputation, and crush injury without degloving. The main diagnostic challenges were defining viable tissue margins and selecting an optimal reconstruction method for functional restoration.

Table 1. Timeline of the Case

Day	Intervention
Day 0	Workplace injury, emergency room admission, evaluation, and preoperative prep
Day 1	First surgery: open reduction, internal fixation of fingers, and debridement
Day 30	Second surgery: wire removal, placement of abdominal pedicled flap
Day 60	Third surgery: flap division and initiation of rehabilitation
Day 90	Ongoing rehabilitation and planning for separation of fused fingers

The patient underwent a staged surgical approach to manage the extensive degloving injury involving multiple fingers and part of the carpal region. The first procedure included open reduction and internal fixation of the affected fingers using Kirschner wires, accompanied by thorough debridement to eliminate necrotic tissue and optimize the wound bed for reconstruction. This step was critical in preventing infection and preserving viable structures necessary for flap attachment (figure 1).



Figure 1. Open Reduction, Internal Fixation and Debridement

One month following the initial surgery, the patient underwent a second procedure involving the removal of the fixation wires and the placement of a pedicled abdominal flap. This flap was used to cover the soft tissue defects of the third, fourth, and fifth fingers, along with the exposed area of the carpal region. The abdominal flap was carefully secured to ensure adequate vascularization and integration during the healing phase (figure 2).



Figure 2. Abdominal Flap Placement

After an additional month, once the flap had demonstrated stable perfusion and tissue adherence, a third surgical procedure was performed to release the flap. This marked the beginning of an intensive rehabilitation program focusing on the mobilization and functional recovery of the involved fingers. Rehabilitation exercises targeted joint flexibility and grip strength, particularly for the index finger and thumb, to preserve hand function and minimize long-term disability (Figure 3, Figure 4).



Figures 3. Abdominal Flap Release



Figure 4. Finger Rehabilitation 1 Month After the Surgery

Following the staged surgical interventions, the patient's middle, ring, and little fingers were successfully covered using a pedicled abdominal flap. Postoperative observation revealed no signs of infection or tissue necrosis, indicating successful integration of the flap with the recipient site. The flap provided sufficient mechanical coverage and protection for the underlying tendons and osseous structures, supporting structural preservation of the hand. The index finger exhibited a limited range of motion, yet this outcome was considered the most viable option to preserve overall hand function given the severity of the injury. Functional rehabilitation was initiated to improve joint mobility, particularly focusing on the index finger and thumb grip strength. The current management plan includes continuous monitoring of flap viability and planning for surgical separation of the fused middle, ring, and little fingers to enhance fine motor capabilities. Long-term rehabilitation remains essential to optimize functional recovery and prevent joint stiffness. The reconstructive approach successfully maintained hand integrity and established a stable foundation for subsequent corrective and rehabilitative procedures.

RESULT AND DISCUSSION

Degloving injuries of the hand represent one of the most severe forms of traumatic avulsion, commonly resulting from industrial accidents involving high-energy mechanical forces. The injury mechanism leads to the separation of the skin and subcutaneous tissues from the underlying musculoskeletal and neurovascular structures, resulting in extensive tissue exposure and functional disruption.(Huang et al., 2019; Kim & Yoon, 2020; Sabapathy et al., 2015) Reconstruction in such cases remains challenging, particularly when the recipient bed is poorly vascularized and direct skin grafting is contraindicated. In the present case, the use of a pedicled abdominal flap served as a strategic approach to ensure durable coverage and structural preservation in a severely damaged hand.(Ilenghoven et al., 2024).

The abdominal flap offers several distinct advantages in the management of extensive soft tissue loss. Its large donor area and stable vascular supply make it well-suited for covering wide defects, especially in injuries involving multiple fingers and the carpal region. In this case, the flap successfully restored coverage of the third, fourth, and fifth fingers while maintaining tissue viability and providing mechanical protection for deeper structures.(Buja et al., 2013; Jian-min et al., 2013; Zelken et al., 2015) The outcome is consistent with the findings by Nazerani et al. (2011), who reported complete flap survival and favorable functional results using a compartmented abdominal flap technique in similar injuries involving multiple digits.(Buja et al., 2013; Nazerani et al., 2011a, 2011b)

Alternative reconstructive options, such as the deep inferior epigastric perforator (DIEP) flap and muscle-sparing transverse rectus abdominis myocutaneous (MS-TRAM) flap, have demonstrated promising results in terms of tissue compatibility and donor site aesthetics.(Jian-min et al., 2013; Senda et al., 2011; Żyluk et al., 2019) However, in resource-limited settings or in cases where microsurgical expertise is unavailable, the pedicled abdominal flap remains a practical and reliable solution. Its use minimizes operative time and avoids the need for complex microvascular anastomoses, thereby reducing perioperative risk in vulnerable patients.(Afshar et al., 2023; Amendola et al., 2022; Ju et al., 2015) The integration of abdominoplasty-style closure techniques further contributes to an improved cosmetic outcome, enhancing overall patient satisfaction. Despite inherent challenges, including infection risk and joint stiffness, close monitoring and early rehabilitation allow for satisfactory long-term functional recovery in patients with extensive degloving injuries.

CONCLUSION

The use of a pedicled abdominal flap offers an effective reconstructive strategy for managing extensive hand degloving injuries, particularly when involving multiple fingers and a compromised recipient site. This technique provides reliable tissue coverage, preserves underlying structures, and facilitates limb salvage in severe trauma cases. Although postoperative challenges such as limited finger mobility and tissue fusion may occur, they can be addressed through staged surgical separation and structured rehabilitation. The case supports the role of abdominal flaps as a practical option in complex upper limb reconstruction, especially in settings with limited resources or when microsurgical alternatives are not feasible.

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REFERENCES

- Afshar, A., Tabrizi, A., & Aidenlou, A. (2023). *A Degloved Hand Was Resurfaced with Sandwich Flaps*. *World Journal of Plastic Surgery*, 12(3), 90–93. <https://doi.org/10.61186/wjps.12.3.90>
- Amendola, F., Spadoni, D., Velazquez-Mujica, J., Platsas, L., & Chen, H.-C. (2022). *The triple conjoined scapular-latissimus dorsi-groin flap for reconstruction of long lower extremity degloving injury: A case report*. *Microsurgery*, 42(3), 277–281. <https://doi.org/10.1002/micr.30827>
- Buja, Z., Arifi, H., & Hoxha, E. (2013). *Repair of degloving fingers with abdominal tunnelization flap*. In *The Journal of hand surgery, European volume* (Vol. 38, Issue 4, pp. 439–440). <https://doi.org/10.1177/1753193412474200>
- Dodakundi, C., Saraj, B., Seidam, M., Saravanamurthy, G., Alawadi, K., & Badawi, H. (2024). *Salvage of Circumferential Multiplane Degloving Injury of Hand with Single Viable Finger - Case Report*. *Journal of Orthopaedic Case Reports*, 14(11), 74–78. <https://doi.org/10.13107/jocr.2024.v14.i11.4920>
- Hakim, S., Ahmed, K., El-Menyar, A., Jabbour, G., Peralta, R., Nabir, S., Mekkodathil, A., Abdelrahman, H., Al-Hassani, A., & Al-Thani, H. (2016). *Patterns and management of degloving injuries: a single national level 1 trauma center experience*. *World Journal of Emergency Surgery : WJES*, 11, 35. <https://doi.org/10.1186/s13017-016-0093-2>
- Hidajat, N. N., Damayanthi, E. D., Akbar, H. F., Magetsari, R. M. S. N., & Hidajat, N. N. (2023). *Replantation using groin flap in thirty-four years old male with traumatic total degloving of little finger: A case report*. *International Journal of Surgery Case Reports*, 108, 108377. <https://doi.org/10.1016/j.ijscr.2023.108377>
- Huang, S. R., Liu, J. T., Zhang, Y., Ouyang, R. L., Ruan, M. Z., & Luo, B. (2019). *[Repair of complex wounds on hands after burns or trauma]*. *Zhonghua shao shang za zhi = Zhonghua shaoshang zazhi = Chinese journal of burns*, 35(5), 362–366. <https://doi.org/10.3760/cma.j.issn.1009-2587.2019.05.007>
- Ilenghoven, D., Ibrahim, S., & Mohd Yussof, S. J. (2024). *Harnessing the Degloved Palm in Crush Injury Management*. *Cureus*, 16(6), e63386. <https://doi.org/10.7759/cureus.63386>
- Jayant, D., Parashar, A., & Sharma, R. (2023). *Traumatic degloving injuries: a prospective study to assess injury patterns, management, and outcomes at a single center in northern India*. *Journal of Trauma and Injury*, 36(4), 385–392. <https://doi.org/10.20408/jti.2023.0032>
- Jian-min, Y., Jia-liang, C., & Jing-hong, X. (2013). *Treatment of degloving injury of the finger with a pedicled split-thickness skin graft*. *Burns : Journal of the International Society for Burn Injuries*, 39(4), e21–4. <https://doi.org/10.1016/j.burns.2012.09.029>
- Ju, J., Li, J., & Hou, R. (2015). *Microsurgery in 46 cases with total hand degloving injury*. *Asian Journal of Surgery*, 38(4), 205–209. <https://doi.org/10.1016/j.asjsur.2015.01.004>
- Kim, J.-H., & Yoon, H.-Y. (2020). *Surgical Reconstruction of the Metatarsal Pad Using Nonweight-Bearing Surfaces of the Footpads in a Dog*. *Journal of the American Animal Hospital Association*, 56(1), e56101. <https://doi.org/10.5326/JAAHA-MS-6834>
- Krishnamoorthy, R., & Karthikeyan, G. (2011). *Degloving injuries of the hand*. *Indian Journal of Plastic Surgery : Official Publication of the Association of Plastic Surgeons of India*, 44(2), 227–236. <https://doi.org/10.4103/0970-0358.85344>
- Lekuya, H. M., Alenyo, R., Kajja, I., Bangirana, A., Mbiine, R., Deng, A. N., & Galukande, M. (2018). *Degloving injuries with versus without underlying fracture in a sub-Saharan African tertiary hospital: a prospective observational study*. *Journal of Orthopaedic Surgery and Research*, 13(1), 2. <https://doi.org/10.1186/s13018-017-0706-9>
- Nazerani, S., Motamedi, M. H. K., Nazerani, T., & Bidarmaghz, B. (2011a). *Treatment of*

- traumatic degloving injuries of the fingers and hand: introducing the “compartmented abdominal flap”*. *Techniques in Hand & Upper Extremity Surgery*, 15(3), 151–155. <https://doi.org/10.1097/BTH.0b013e3182051c02>
- Nazerani, S., Motamedi, M. H. K., Nazerani, T., & Bidarmaghz, B. (2011b). *Treatment of Traumatic Degloving Injuries of the Fingers and Hand*. *Techniques in Hand & Upper Extremity Surgery*, 15(3), 151–155. <https://doi.org/10.1097/BTH.0b013e3182051c02>
- Sabapathy, S. R., Venkatramani, H., & Martin Playa, P. (2015). *The use of pedicled abdominal flaps for coverage of acute bilateral circumferential degloving injuries of the hand*. *Trauma Case Reports*, 1(3–4), 25–31. <https://doi.org/10.1016/j.tcr.2015.08.001>
- Senda, H., Muro, H., Terada, S., & Okamoto, H. (2011). *A case of degloving injury of the whole hand reconstructed by a combination of distant flaps comprising an anterolateral thigh flap and a groin flap*. *Journal of Reconstructive Microsurgery*, 27(5), 299–302. <https://doi.org/10.1055/s-0031-1278708>
- Wang, X., Zhang, P., & Zhou, Y. (2013). *Replantation of a circumferentially degloved ring finger by venous arterializations*. *Indian Journal of Orthopaedics*, 47(4), 422–424. <https://doi.org/10.4103/0019-5413.114939>
- Weinand, C. (2018). *Degloving Injuries of Upper Extremity: A Strategy with Full Thickness Skin Mesh*. *World Journal of Plastic Surgery*, 7(3), 372–376. <https://doi.org/10.29252/wjps.7.3.372>
- Zelken, J. A., Chang, N., Wei, F., & Lin, C. (2015). *The combined ALT-groin flap for the mutilated and degloved hand*. *Injury*, 46(8), 1591–1596. <https://doi.org/10.1016/j.injury.2015.05.022>
- Żyluk, A., Szlosser, Z., & Puchalski, P. (2019). *The results of the treatment of hand - Outcomes of the treatment of hand degloving injuries with greater omentum flaps*. *Polski Przegląd Chirurgiczny*, 91(6), 20–27. <https://doi.org/10.5604/01.3001.0013.5495>