

Case Report

First and second dorsal metacarpal artery free flap in a degloving case

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ABSTRACT

Digital degloving injuries are uncommon but represent a significant challenge in hand surgery due to the circumferential loss of coverage, bone exposure, and functional compromise. Although multiple reconstructive options have been described, none has become the gold standard, and in many cases the outcome ends in amputation. We report a 55-year-old male patient with a circumferential degloving injury of the left index finger, showing complete bone exposure of the middle and distal phalanges and partial exposure of the proximal phalanx. Surgical management consisted of debridement and resection of necrotic tissue, followed by reconstruction using two synchronous contralateral free Kite flaps to cover the dorsal and volar surfaces, in addition to a full-thickness skin graft to the residual radial wound. Postoperative evolution was satisfactory, with 90% graft integration and complete flap viability. At six months, the donor site exhibited full healing, preserved mobility, intact pinch function, and no residual pain. The synchronous use of double free Kite flaps constitutes an innovative, anatomically faithful, and low-morbidity alternative for managing circumferential digital injuries. This case expands the clinical spectrum of the kite flap and suggests new possibilities for application in complex microsurgical hand reconstruction.

Keywords: Kite flap, Microsurgery, Digital degloving, Free flap, Case report

INTRODUCTION

Digital degloving injuries are rare but represent one of the greatest challenges in hand reconstructive surgery due to the exposure of deep structures, three-dimensional loss of coverage, and resulting functional impairment.¹ Various reconstructive strategies have been reported, including groin, McGregor, and radial flaps, skin grafts, microsurgical techniques, and local flaps. However, none of these options has emerged as the ideal tool for treating such lesions, and unfortunately, amputation often remains the outcome.^{2,3}

In this context, we present the innovative use of a flap based on the first and second dorsal metacarpal arteries as an alternative for circumferential coverage in a digital degloving injury. This technique allowed a tridimensional,

functional, and aesthetic reconstruction with excellent donor-site recovery, positioning it as a promising option for selective digital reconstruction.⁴

CASE REPORT

A 55-year-old male worker, with no relevant medical history, presented to our unit 24 hours after sustaining a blunt-cut injury to the left hand (June 4, 2025). Physical examination revealed a raw area on the index finger with an asymmetric circumferential defect of approximately 6 cm in length, complete bone exposure of the middle and distal phalanges, and partial exposure of the proximal phalanx. No limitation in flexion or extension arcs was observed. An additional Allen I injury was documented at the tip of the third finger of the same hand.

The patient was taken to the operating room, where surgical debridement and washing were performed, revealing distal phalangeal necrosis that required resection. For coverage of the remaining defect, the use of free flaps from the contralateral hand dorsum was planned.

Two independent skin islands were designed on the right hand: the first over the dorsum of the second metacarpal and the second over the dorsum of the third metacarpal. Both were elevated at the supraparatenodinous level, including the fascia of the first dorsal interosseous to preserve pedicle integrity. The pedicle of the first dorsal metacarpal artery was dissected proximally to its origin before the dorsal radial artery at the anatomic snuffbox. The second dorsal metacarpal artery pedicle was dissected to its origin at the dorsal carpal arch, identifying the trifurcation with the dorsal radial artery and the first dorsal metacarpal artery.

The flaps were configured to cover the dorsal and palmar surfaces of the left index finger, respectively. Additionally, a full-thickness skin graft from the right brachial region was placed over the residual raw area of the first interdigital space of the left hand.

Arterial anastomosis was performed end-to-end between the flap artery and the proximal segment of the first common palmar artery. Venous drainage was achieved using one dorsal superficial and one deep comitant vein, with two venous anastomoses (superficial and deep) using 8-0 nylon. The donor site was covered with a partial-thickness skin graft from the ipsilateral thigh.

Both cutaneous islands showed favorable evolution, with adequate color, turgor and capillary refill during immediate clinical monitoring. Patient remained hospitalized for 5 days under close postop surveillance, antibiotic therapy and scheduled removal of dressing over skin graft. Graft demonstrated approximately 90% integration without infection/ dehiscence.

Weekly outpatient follow-up showed satisfactory progress of both flap and graft. At six months, the donor site on the contralateral hand dorsum had completely healed, with good graft integration and no local complications. Functionally, the patient preserved full index finger mobility, maintained pinch strength, and reported no residual pain. He was discharged with a rehabilitation plan for functional evaluation and motor recovery.



Figure 1 (A-D): Preoperative and intraoperative clinical images (A-D). A-Palmar view of the left hand showing a digital degloving defect of the second finger, with bone exposure and necrotic wound edges. B-Radial view demonstrating soft-tissue retraction and absence of skin coverage. C-Dorsal view of the second finger with raw tissue exposure and ischemic changes. D-Intraoperative image showing the design and elevation of the double flap (two skin islands) based on the dorsal metacarpal arteries, prior to microvascular transfer.



Figure 2 (A-C): Postoperative clinical images-left hand (A-C). A-Dorsal view showing satisfactory flap integration without dehiscence or signs of necrosis. B-Radial view demonstrating progressive flap healing with adequate adaptation to the digital anatomy. C-Palmar view showing complete coverage of the second finger.



Figure 3 (A-C): Postoperative clinical images-right hand (A–C). A-Radial view of the right hand showing a linear scar at the donor site region. B-Dorsal view demonstrating proper healing of the donor site. C-Left hand performing a pinch test with a coin, showing preserved mobility and strength of the second finger.

DISCUSSION

Digital degloving injuries represent one of the greatest challenges in hand reconstructive surgery, particularly when there are bone exposure, circumferential soft-tissue loss, and functional impairment. They are defined as the complete avulsion of skin and subcutaneous tissue, leaving no viable local coverage and thus requiring advanced reconstructive techniques. Shen et al reported favorable functional results using microsurgical flaps in such cases, emphasizing the importance of restoring both form and function.⁵ Similarly, Krishnamoorthy and Karthikeyan highlighted that ideal coverage must restore sensation, aesthetics, and mobility.⁶ Lin et al validated the use of free fasciocutaneous flaps for circumferential injuries, achieving adequate integration and preserved function, supporting the use of three-dimensional reconstructive solutions such as the one presented in this case.^{7,8}

In situations involving circumferential tissue loss and bone exposure, the reconstructive technique must prioritize thin tissue coverage, three-dimensional adaptability, and minimal donor-site morbidity. Classical options such as the radial forearm or anterolateral thigh flaps provide wide coverage but tend to be bulky and yield limited aesthetic results. Chi et al described spiral medial arm flaps that achieve complete coverage but with higher technical complexity.⁹ Yazar et al compared radial and anterolateral flaps, finding more complications in digital reconstructions due to the excess thickness of the tissues.¹⁰ In contrast, the use of bilobed convergent flaps, as in our case, allowed dorsal and volar surface coverage with a single anastomosis and thin tissues that preserved the digital contour, making it an anatomically and functionally coherent alternative that is rarely reported.¹¹

The Kite flap, based on the dorsal metacarpal artery, has proven to be thin, anatomically adaptable, and sensate, which makes it particularly useful for reconstructing defects of the fingertip, dorsal surface, and distal

phalanx.¹² Originally described by Foucher and Braun as an island transfer from the dorsum of the index finger, it was later modified by Dautel and Merle, who consolidated its reliability thanks to its constant pedicle and predictable surgical trajectory.^{12,13} In its free microsurgical application, Krishnan et al reported a high success rate and excellent functional integration, extending its utility beyond regional use.¹⁴ Likewise, Stulpinas et al documented successful reconstructions using free flaps tailored to specific injury patterns in cases where local skin was not available.¹⁵

Based on the original description of the Kite flap by Foucher and Braun and the anatomic studies by Dautel and Merle, who detailed the vascular variations and the relevance of perforators arising from the first and second dorsal metacarpal arteries, we developed the idea of adapting this design to more complex reconstructive scenarios. Supported by recent reports validating the use of free fasciocutaneous flaps for severe digital defects, we designed the innovative technique presented in this case: a free flap with two cutaneous islands dependent on perforators from the first and second dorsal metacarpal arteries, intended to provide circumferential, functional, and aesthetic coverage of the injured finger.^{16,17} This configuration represents a rarely documented microsurgical adaptation but one of significant value for cases with multidirectional exposure of deep structures.¹⁸

The innovation lies in the synchronous use of two Kite flaps based on different arterial branches, unified through a single anastomosis, which enabled efficient three-dimensional coverage with minimal morbidity. This choice responded not only to vascular considerations but also to the need to preserve sensitivity, contour, and joint function. The outcome was complete flap integration without complications and preserved function at six months postoperatively. Nevertheless, it must be recognized that this is a single-case report, and to our knowledge, there are no previous reports describing a dual-island free flap combining the first and second

dorsal metacarpal arteries. Further cases and comparative studies are required to validate its reproducibility and to establish its role among other reconstructive alternatives.

CONCLUSION

This case demonstrates that the flap, historically used in thumb and certain facial reconstructions, can be innovatively adapted to digital injuries with circumferential tissue loss and bone exposure. The synchronous use of two convergent contralateral flaps allowed for an anatomical, functional, and aesthetic three-dimensional restoration while avoiding the use of more aggressive or higher-morbidity techniques.

The proposed configuration stands out for its versatility, low donor-site morbidity, and anatomic fidelity, positioning this flap as a viable and reproducible alternative in complex microsurgical hand surgery scenarios. This report broadens its clinical applicability and may establish it as a preferred option in the management of digital degloving injuries.

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REFERENCES

- Singh AP, Dixit PK, Agrawal D, Deepti K, Shilpi K, Priyanka S, et al. Dorsal metacarpal artery perforator flaps for traumatic soft tissue defect of finger: a prospective anatomical and clinical study. *Chin J Traumatol.* 2020;23(5):292-7.
- Abdel-Ghani A, Maher M. First dorsal metacarpal artery perforator flap for thumb and finger defects. *J Hand Surg Eur Vol.* 2020;45(4):395-401.
- Bakhach J, Choughri H, Ghanem AM, Qassemayr Q. First dorsal metacarpal artery flap: A versatile solution for defects of the thumb and the hand. *Arch Plast Surg.* 2022;49(2):181-6.
- Ozdemir R, Mavili E, Sevin K, Baran CN. First dorsal metacarpal artery island flap: Clinical experience with 24 cases. *Plast Reconstr Surg.* 2002;110(5):1091-7.
- Shen XF, Mi JY, Xue MY, Gang Z, Li Q, Xiao Z, et al. Modified great toe wraparound flap with preservation of plantar triangular flap for reconstruction of degloving injuries of the thumb and fingers: Long-term follow-up. *Plast Reconstr Surg.* 2016;138(1):155-63.
- Krishnamoorthy R, Karthikeyan G. Degloving injuries of the hand. *Indian J Plast Surg.* 2011;44(2):227-36.
- Lin C, Chen S, Chen T, Niann-Tzyy D, Shun-Cheng C. Free fasciocutaneous flaps for reconstruction of complete circumferential degloving injury of digits. *Microsurgery.* 2013;33(3):191-7.
- Amjed H, Heffernan A, Mahajan AL. Dorsal metacarpal artery perforator flaps for resurfacing digital defects: a reliable, thin and sensate option. *J Plast Reconstr Aesthet Surg.* 2018;71(6):833-9.
- Chi Z, Gao W, Yan H, Li Z, Chen X, Zhang F. Reconstruction of totally degloved fingers with a spiraled parallelogram medial arm free flap. *J Hand Surg Am.* 2012;37(5):1042-50.
- Couceiro J, de Prado M, Menéndez G, Manteiga Z. The first dorsal metacarpal artery flap family: a review. *Surg J (N Y).* 2018;4(4):e215-9.
- Yazar S, Lin CH, Lin YT, Wei FC. Outcome comparison between free anterolateral thigh and radial forearm flap in reconstruction of large soft-tissue defects around the elbow. *Plast Reconstr Surg.* 2006;117(7):2468-75.
- Foucher G, Braun JB. A new island flap transfer from the dorsum of the index to the thumb. *Plast Reconstr Surg.* 1979;63(6):344-9.
- Hongwei L, Yichen L, Jun Z. The use of dorsal metacarpal artery perforator flaps in the treatment of finger soft tissue defects. *J Reconstr Microsurg.* 2020;36(4):301-7.
- Krishnan NM, Fischer LH, Friedrich JB. The first dorsal metacarpal artery perforator free flap for resurfacing complex hand and digit defects. *J Reconstr Microsurg.* 2014;30(6):403-10.
- Stulpinas A, Venciūtė-Stankevičė R, Jakutis N. Surgical treatment of finger degloving injuries without usable skin: a case report and literature review. *Lietuvos Chirurgija.* 2022;21(3-4):229-37.
- Dautel G, Merle M, Borrelly J, Michon J. Variations anatomiques du réseau vasculaire de la première commissure dorsale: Applications au lambeau cerf-volant. *Ann Chir Main.* 1989;8(1):53-9.
- Zyluk A, Flicinski F. Outcomes of coverage of soft tissue defects in the thumb with a "Kite flap". *Handchir Mikrochir Plast Chir.* 2023;55(1):47-52.
- Tos P, Titolo P, Chirila NL. Free dorsal metacarpal artery perforator flap for complex defects of the fingers: anatomical basis and clinical experience. *J Hand Surg Eur Vol.* 2013;38(4):410-7.

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