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ABDOMINAL POCKET FLAP-GRAFT FOR COMPLEX DIGITAL SOFT-TISSUE DEFECTS: A THREE-CASE REPORT AND NARRATIVE REVIEW OF THE LITERATURE

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ABSTRACT

Complex digital soft-tissue defects with exposed bone, tendons, or joints remain a challenging reconstructive problem. Local and regional flaps may be insufficient for extensive or circumferential defects, while free-tissue transfer requires microsurgical expertise, suitable recipient vessels, and appropriate resources. The abdominal pocket flap-graft is a staged pedicled technique that provides vascularized soft-tissue coverage without microsurgical anastomosis.

We report three clinical cases managed with abdominal flap-grafting. The first was a 23-year-old man with circumferential degloving of the ring finger and exposure of bone and flexor and extensor tendons; the finger remained attached to the abdomen for 23 days and complete flap survival was obtained, with preserved digital mobility after separation. The second was a 16-year-old girl with traumatic distal phalanx amputation of the index finger and exposed bone; abdominal pocketing was chosen to preserve digital length. The finger remained attached for 25 days, with complete flap survival but limited postoperative mobility. The third was a 40-year-old woman with deep burns of the dorsal second, third, and fourth fingers; after necrosectomy exposed phalanges and tendons required immediate coverage. An abdominal flap with separate tunnels was used, followed by staged weaning; full finger function was recovered at four months, although flap bulk required secondary defatting.

A narrative review of the literature was undertaken to place these cases in the context of contemporary hand reconstruction. Abdominal-based pedicled flaps remain useful in selected patients with extensive defects, compromised or unavailable recipient vessels, multiple-surface injuries, or limited access to microsurgery. Their principal limitations are staged surgery, immobilization, discomfort, bulk, and postoperative stiffness. Contemporary series suggest that physiotherapy of the attached hand may be feasible in selected configurations and may reduce stiffness.

The abdominal pocket flap-graft therefore remains a salvage and reconstructive option for selected complex digital defects. Careful patient selection, flap design, protection of the pedicle, early rehabilitation when technically feasible, and realistic counseling regarding staged reconstruction are essential.

Keywords: Abdominal pocket flap; Abdominal flap-graft; Pocketing; Digital reconstruction; Finger injury; Soft-tissue defect; Pedicled flap; Hand reconstruction.

1 INTRODUCTION

Complex soft-tissue defects of the fingers require coverage that is stable, vascularized, durable, and compatible with preservation of digital length and function. Exposure of bone, tendon, joint, or other poorly vascularized structures generally precludes simple skin grafting and may necessitate flap coverage. The reconstructive choice depends on the size and geometry of the defect, the structures exposed, the vascular status of the digit, the condition of adjacent tissues, patient factors, and the resources and expertise available.

Local and homodigital flaps can provide excellent tissue quality and, in selected indications, sensibility. Regional and free flaps broaden the reconstructive possibilities but may be limited by donor-site morbidity, vascular sacrifice, microsurgical requirements, or the condition of recipient vessels. Contemporary reviews emphasize that abdominal-based pedicled flaps have a narrower but persistent role, particularly for extensive or multi-surface defects, absent or damaged recipient vessels, situations in which preservation of major vascular axes is desirable, and circumstances in which microsurgical reconstruction is unsuitable or unavailable [1,2].

The abdominal pocket flap-graft is a remote pedicled technique in which the injured digit is temporarily buried in a subcutaneous abdominal pocket. Vascularized abdominal skin covers the defect while the digit remains connected to its abdominal blood supply; after a period of attachment, the flap is divided and the digit is released. The technique can provide substantial tissue coverage and may preserve digital length, but it requires staged reconstruction and imposes a period of immobilization.

The present report describes three clinical cases from our experience and adds a narrative review of the literature.

2 PATIENTS AND METHODS

2.1 Case series

Three patients with complex digital soft-tissue defects underwent abdominal pocket or abdominal flap-graft reconstruction in the setting of the Department of Plastic, Reconstructive and Aesthetic Surgery, HUG Mohammed VI Tangier, Morocco. Clinical details, operative strategy, flap survival, need for staged division, and available functional outcomes were reviewed from the source case reports and clinical material provided for this manuscript. Because this is a three-case descriptive report, no inferential statistical analysis was performed. The clinical characteristics and outcomes of the three cases are summarized in Table 1.

2.2 Narrative literature review

A narrative literature review was performed using PubMed-indexed publications and publisher records identified with combinations of the terms abdominal flap, abdominal pedicled flap, abdominal pocket flap, pocketing, flap-graft, hand reconstruction, finger reconstruction, and pedicled flap. Literature addressing indications, technique, flap survival, rehabilitation, complications, and the contemporary role of pedicled abdominal flaps was prioritized. This was a narrative review rather than a systematic review; therefore, no PRISMA flow diagram or formal risk-of-bias assessment was undertaken.

3 CASE REPORTS

3.1 Case 1: Circumferential degloving injury of the ring finger

A 23-year-old man with no notable medical history presented after a sports-related hand injury caused by direct impact from a metal object. Examination showed a severe circumferential degloving injury of the ring finger of the left hand, with extensive soft-tissue loss and exposure of bone and both flexor and extensor tendons. Active flexion and extension of the proximal phalanx were preserved. The initial neurovascular examination of the digit was difficult to assess reliably because of the extent of the injury.



Figure 1: Severe circumferential degloving injury of the ring finger of the left hand, with exposure of bone and flexor and extensor tendons, at presentation.

An abdominal pocket flap-graft was selected. Under local anesthesia, the abdominal skin was infiltrated with adrenaline-containing saline and a subcutaneous pocket was created through a limited incision. The injured finger was introduced into the pocket and the flap edges were secured to the peri-wound skin to prevent retraction and maintain tissue contact.



Figure 2: Immediate postoperative appearance following burial of the ring finger in the abdominal subcutaneous pocket.

The postoperative course was uneventful. Daily dressings were performed and no donor-site infection was reported. The finger remained attached to the abdominal wall for 23 days, with complete clinical flap viability and no evidence of ischemia or necrosis. After separation, digital mobility was preserved and hand and wrist rehabilitation was undertaken. At the latest available follow-up in the source manuscript, durable soft-tissue coverage was documented; the exact duration of follow-up was not specified. The transferred abdominal skin retained donor-site pigmentation and hair-bearing characteristics, creating a visible difference from adjacent digital skin.



Figure 3: Appearance of the abdominal flap during the weaning stage, before definitive separation.



Figure 4: Final appearance of the reconstructed ring finger after flap division, palmar view, showing the digit covered by the transferred abdominal skin.



Figure 5: Final appearance of the reconstructed ring finger of the left hand after flap division, dorsal view, with preserved digital extension.

3.2 Case 2: Distal index-finger amputation with exposed bone

A 16-year-old girl presented after a sports-related traumatic injury to the left hand. Examination demonstrated avulsion amputation of the distal phalanx of the index finger with exposed bone at the stump. She was afebrile and the remainder of the examination was unremarkable. Standard radiographs confirmed loss of the distal phalanx without an associated bony injury of the hand.



Figure 6: Radiograph showing the loss of the distal phalanx.



Figure 7: Traumatic avulsion amputation of the distal phalanx of the left index finger, with exposed bone.

Because the reconstructive objective was to cover the exposed bone while avoiding additional shortening of the digit, an abdominal pocket flap-graft was selected. A subcutaneous abdominal pocket was created and the injured finger was buried within it. The flap edges were secured to the peri-wound skin.



Figure 8: Immediate postoperative appearance after burial of the index finger in the abdominal pocket.

The finger remained attached to the abdominal wall for 25 days. The postoperative course was uneventful and complete flap survival was obtained without reported necrosis. After flap division, the digit remained viable. Rehabilitation was subsequently undertaken. Digital mobility was limited at the available follow-up.

3.3 Case 3: Deep dorsal burns of multiple fingers

A 40-year-old woman, a seamstress, with a history of hysterectomy for fibroid uterus and appendectomy 20 years previously, presented 12 hours after a domestic hot-oil burn. The injury involved the second, third, and fourth fingers of the right hand. The dorsal surface of these fingers showed third-degree burns, while the left hand had second-degree burns. The patient was hemodynamically stable, with blood pressure 120/80 mmHg, heart rate 84 beats/min, Glasgow Coma Scale 15/15, and respiratory rate 26/min. Proximal joint mobility was preserved.

The patient underwent necrosectomy, which exposed the phalanges and tendons and created an indication for immediate vascularized coverage. Several reconstructive options were discussed; the patient declined most alternatives because of concerns about their aesthetic consequences. In addition, she had a pre-existing appendectomy scar. An abdominal flap was therefore chosen.

The homolateral abdominal skin was preferred to the outer surface of the contralateral arm because the abdominal donor-site scar was expected to be less visible and the abdomen provided a larger available skin surface. After hydrodissection with adrenaline-containing saline, a superficial dissection was performed. Separate tunnels were created for each finger to keep the digits apart and provide stable support. The flap edges were secured with several sutures to limit retraction, and a Delbet drain was used. A dressing with healing cream and topical antibiotic was applied.

The postoperative course was uncomplicated. Daily Betadine dressings were performed. There was no reported donor-site infection or distal flap suffering; the digits remained warm with preserved sensitivity, normal recoloration, and a positive prick test. At six weeks, the flap adjacent to the second finger was delayed and subsequently weaned under local anesthesia. The remaining fingers were released during a later ambulatory procedure. The donor site was closed by skin-edge approximation after detachment. Intensive rehabilitation of the fingers, hand, wrist, and shoulder followed.



Figure 9: Dorsal aspect of the burned right hand before debridement.



Figure 10: Palmar aspect of the burned right hand before debridement.



Figure 11: Dorsal aspect of the burned left hand before debridement.



Figure 12: Immediate postoperative appearance after abdominal flap coverage.



Figure 13: First stage of flap weaning under local anesthesia, with partial weaning of the flap at the radial border of the index finger.



Figure 14: Appearance after complete flap weaning.



Figure 15: Separation of the second and third fingers under local anesthesia.

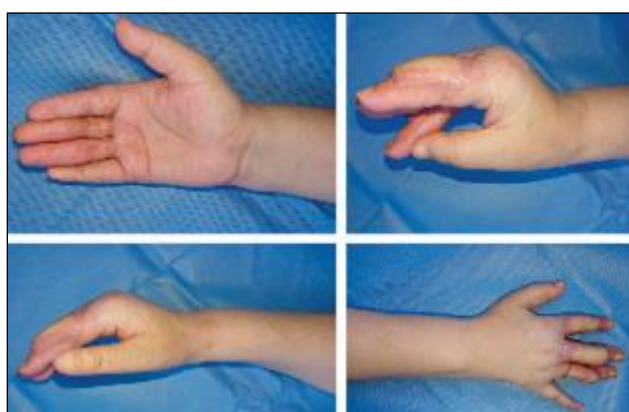


Figure 16: Separation of the remaining fingers with light defatting.



Figure 17: Final result at four months, showing progressive recovery of finger function and the need for contour refinement.

At four months, the patient had recovered full finger function. The flap was initially hypertrophic, requiring defatting of the second finger to improve contour and flexibility. Additional defatting of the remaining fingers was planned, although the patient was satisfied with the result.

4 NARRATIVE REVIEW OF THE LITERATURE

4.1 Historical and technical basis

The flap-graft concept described by Colson established the principle of using a temporarily attached flap to provide vascularized coverage and subsequently dividing the pedicle [3,4]. Abdominal and groin-based pedicled flaps

subsequently became established options for complex hand reconstruction. Although microsurgery has transformed the management of large soft-tissue defects, abdominal-based flaps have not disappeared; rather, their indications have become more selective.

Table 1: Clinical characteristics, flap survival, and functional outcomes of the three patients.

Case	Age / sex	Indication	Attachment	Flap survival	Functional outcome
1	23 M	Circumferential ring-finger degloving; bone + flexor/extensor tendon exposure	23 days	Complete	Digital mobility preserved
2	16 F	Distal index-finger amputation; exposed bone; length preservation	25 days	Complete	Limited mobility
3	40 F	Deep dorsal burns of 2nd–4th fingers; exposed phalanges/tendons after necrosectomy	Staged; first release at 6 weeks	Complete	Full finger function at 4 months; secondary defatting for bulk

4.2 Contemporary indications

Wagner, Carr, and Netscher reviewed contemporary indications for abdominal-based flaps and emphasized several situations in which they remain useful: patient or facility factors that make microsurgery undesirable, absent or injured recipient vessels, prior use of recipient vessels, the need to preserve major vascular axes for future reconstruction, and large multi-surface wounds [1]. A separate review defining indications for pedicled groin and abdominal flaps similarly identified selected complex situations such as mutilating hand injuries, multiple digital amputations where preservation of length is important, and defects in which microsurgical options are unsuitable [2].

These indications are particularly relevant to the abdominal pocket technique, in which the digit can be positioned directly into a vascularized abdominal pocket without requiring microsurgical anastomosis. In the present series, the three cases illustrate three different reasons for using the technique: extensive circumferential tissue loss, preservation of digital length after amputation, and deep burn-related exposure of tendons and phalanges.

4.3 Flap survival and reliability

The literature generally describes pedicled abdominal flaps as reliable when appropriately designed and protected. A contemporary 2025 review cited series with high rates of flap survival, including 85.3% survival in a 34-patient series of random-pattern abdominal pedicled flaps, with partial necrosis in 11.8% and complete flap loss in 2.9%; another series of 10 vertical-pattern abdominal flaps reported 100% survival [6]. These figures come from heterogeneous abdominal flap designs and should not be interpreted as a pooled estimate specifically for the pocket technique.

In the present three cases, all flaps survived completely. However, this observation is descriptive and cannot establish a complication rate because of the very small sample size and the absence of a comparator group.

4.4 Immobilization and rehabilitation

Immobilization is one of the principal disadvantages of pedicled abdominal reconstruction. The attached hand may be difficult to mobilize, and prolonged positioning can contribute to stiffness of the fingers, wrist, elbow, and shoulder. Al-Qattan et al. retrospectively reviewed 70 adults who underwent pedicled abdominal flap reconstruction with physiotherapy of the attached hand. They reported no dehiscence, infection, or hematoma; six patients had minor partial flap-edge necrosis. Among 62 patients who performed the prescribed exercises adequately, range of motion of the uninjured digits was 90%–100% of normal immediately after division and subsequently returned to full range within two weeks. The authors concluded that active exercises of the attached hand are feasible in selected configurations and may reduce stiffness [5].

This concept is relevant to pocketing but cannot be universally applied. The feasibility of rehabilitation depends on flap geometry, pedicle length, the number of involved digits, the extent of the defect, fixation security, pain, and patient tolerance. In the present series, mobility was preserved in Case 1 but limited in Case 2, illustrating that flap survival does not necessarily translate into optimal functional recovery.

4.5 Bulk, contour, and donor-site considerations

Abdominal skin may be thicker and morphologically different from native digital skin. Bulky transferred tissue can limit contour and dexterity, and secondary thinning or defatting may be required. Case 3 illustrates this issue: full finger function was recovered, but secondary defatting was required to improve contour and flexibility. Donor-site scarring is another consideration, although the abdomen may provide a relatively concealed scar compared with some upper-extremity donor sites.

4.6 Comparison with local, regional, and free flaps

Local and homodigital flaps remain attractive for small and appropriately located defects because they can provide tissue similar to the recipient site and may preserve sensibility. Their limitations become important in circumferential injuries, multiple-digit defects, or when adjacent tissues are severely damaged. Regional flaps can provide reliable coverage but may involve donor-site morbidity or, depending on the technique, sacrifice of a major vascular axis. Free flaps offer substantial versatility for extensive defects but require microsurgical expertise, recipient vessels, and suitable infrastructure [1,2].

A 2025 systematic review and meta-analysis comparing free and pedicled flaps for hand reconstruction included nine studies and 839 hands. The authors reported lower revision rates with free flaps, while pedicled flaps had fewer infections and slightly less flap necrosis in the pooled data [7]. Because the included studies were heterogeneous and not specific to abdominal pocketing, these findings should be interpreted as context rather than direct evidence for choosing one technique in an individual patient.

4.7 Recent evidence and the continuing role of abdominal flaps

Recent publications continue to document the role of abdominal pedicled flaps in hand reconstruction. A 2024 case report described a pedicled abdominal skin flap for a complex full-thickness palmar hand burn involving multiple digits, followed by staged necrotomy, flap thinning, and digit separation [9]. A 2025 Cureus report similarly described abdominal pedicled flap reconstruction as an alternative when microsurgery is not an option [6]. These contemporary reports support the concept that abdominal flaps remain relevant as a practical reconstructive option in selected settings, despite the broader availability of microsurgical reconstruction.

4.8 Practical selection criteria

Based on the available literature and the present three cases, abdominal pocket flap-grafting may be considered when the following features are present:

- Deep digital soft-tissue loss with exposed bone, tendon, or joint that cannot be reliably skin-grafted;
- Extensive or circumferential defects exceeding the practical limits of local tissue;
- Multiple digital defects that can be accommodated by an abdominal flap configuration;
- A need to preserve digital length, particularly when further shortening would compromise function or future reconstruction;
- Absence, damage, or limited availability of suitable recipient vessels;
- Lack of microsurgical expertise, equipment, or an appropriate clinical setting for free tissue transfer;

A patient for whom a shorter and technically simpler pedicled procedure is preferable after individualized discussion of its staged nature and limitations.

4.9 Limitations of the evidence

The literature on abdominal pocketing consists predominantly of case reports, retrospective series, and narrative reviews. There is substantial heterogeneity in flap design, indications, timing of division, rehabilitation protocols, and outcome assessment. Objective measures of range of motion, grip strength, sensibility, patient-reported outcomes, and long-term aesthetic satisfaction are inconsistently reported. The present three-case series is limited by its small sample size and incomplete long-term functional measurements. Case 3 has been previously reported as an individual case report [8] and is included here to provide a broader clinical perspective on the indications and outcomes of abdominal flap-grafting.

5 DISCUSSION

The three cases demonstrate that abdominal pocket flap-grafting can be adapted to different patterns of severe digital tissue loss. Case 1 involved circumferential degloving with simultaneous exposure of bone and both flexor and extensor tendons. Case 2 emphasized preservation of digital length after distal amputation. Case 3 involved deep thermal injury

affecting several fingers and required coverage after excision of necrotic tissue. Despite these different mechanisms and reconstructive objectives, all three flaps survived.

The main benefit of the technique is the provision of vascularized tissue without microsurgical anastomosis. The abdomen also offers a relatively large surface area and can accommodate multiple digits. In selected patients, this can make the technique a useful salvage procedure when local options are inadequate or when microsurgery is not feasible.

The principal trade-off is the staged nature of reconstruction. The hand or digit remains attached to the abdomen, which may impair mobility and comfort and may contribute to stiffness. The available literature suggests that carefully designed physiotherapy can be performed during attachment in selected patients, but this requires an individualized configuration and close monitoring [5].

Our functional observations reinforce an important principle: flap survival is not equivalent to functional success. Case 1 had preserved digital mobility, whereas Case 2 had limited mobility despite complete flap survival. Case 3 recovered full finger function but required secondary defatting for contour and flexibility. Functional assessment should therefore include range of motion, rehabilitation requirements, contour, and patient satisfaction whenever follow-up data are available.

In the current microsurgical era, abdominal pocketing should not be viewed as a replacement for free tissue transfer. Rather, it remains one component of the reconstructive armamentarium for selected complex hand and digital defects. The appropriate technique should be chosen after considering the defect, recipient vessels, available expertise, patient priorities, and expected functional outcome.

6 CONCLUSION

The abdominal pocket flap-graft remains a useful staged reconstructive option for selected complex digital soft-tissue defects, particularly when local coverage is insufficient, microsurgical reconstruction is unsuitable or unavailable, recipient vessels are compromised, or preservation of digital length is important. In this three-case experience, complete flap survival was obtained in all patients, while functional outcomes varied according to the initial injury and rehabilitation course. The main limitations of the technique are staged surgery, immobilization, patient discomfort, stiffness, and potential flap bulk. Careful patient selection, secure flap inset, vigilant postoperative monitoring, and rehabilitation adapted to the flap configuration are essential.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

The authors declare no competing interests.

Statement of informed consent

Written informed consent was obtained from all patients for publication of this case report and its associated clinical and radiological images. For Case 2, the patient was a minor; written consent for publication was signed by her parents/legal guardians.

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